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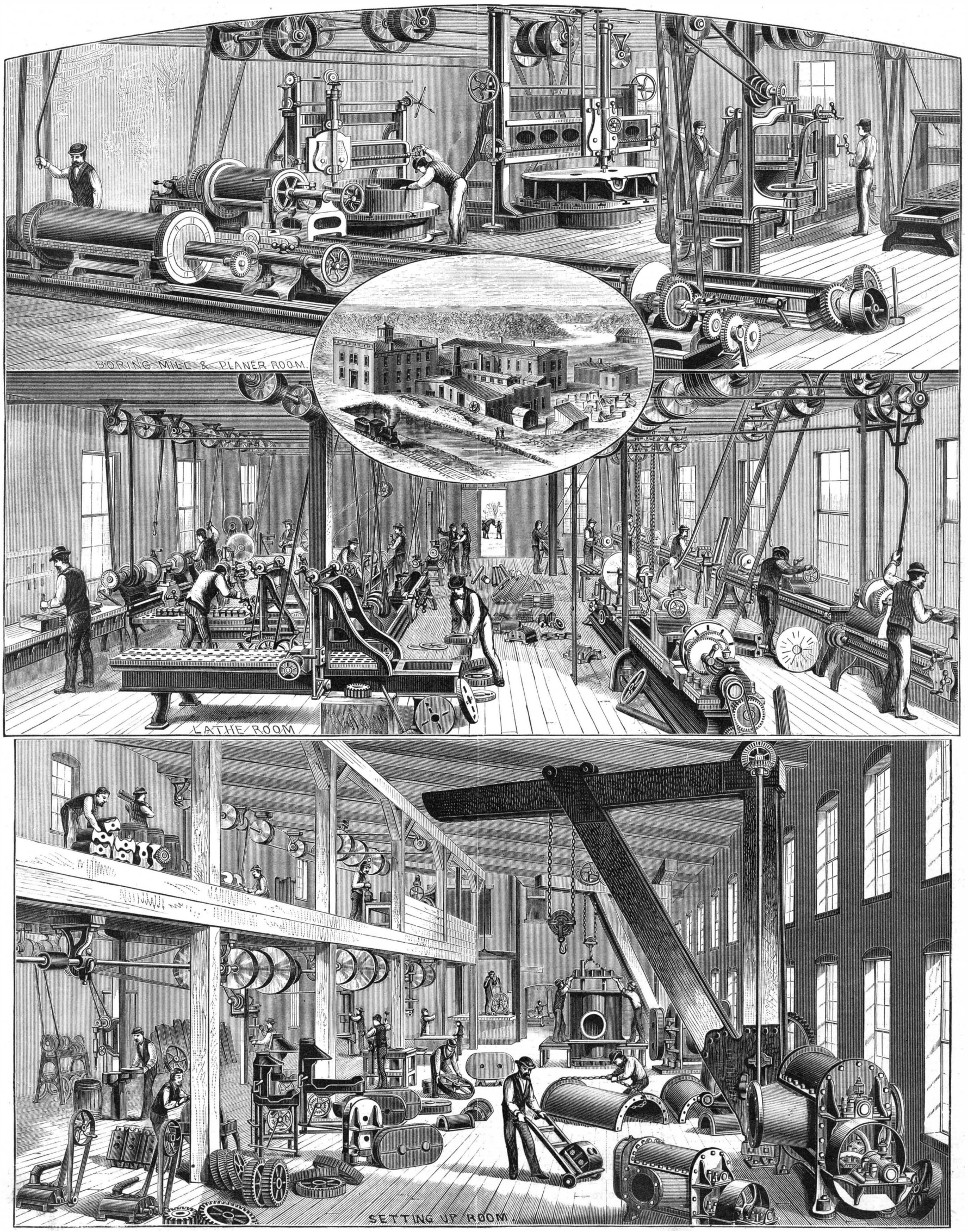

THE MANUFACTURE OF ROTARY PRESSURE BLOWERS.—WORKS OF P. H. & F. M ROOTS, CONNERSVILLE, IND.—[See page 130.]

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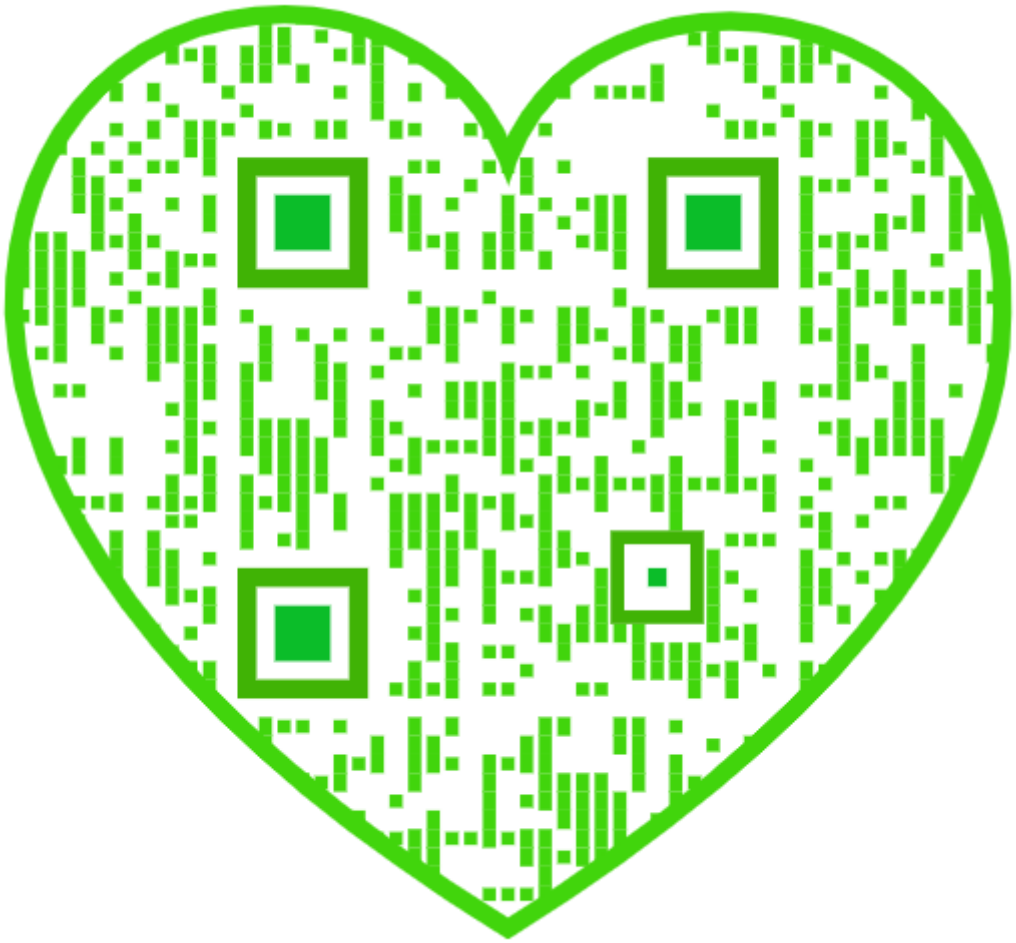

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NEW YORK, SATURDAY, FEBRUARY 28, 1880.

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PASSAGE BY THE HOUSE OF REPRESENTATIVES OF A LAW FOR THE ENCOURAGEMENT OF SWINDLING.

In the SCIENTIFIC AMERICAN of January 3, and again January 17, the injustice and mischievous tendency of certain bills for the protection of such as purchase patented articles and processes from parties unauthorized to sell, were pointed out and discussed at considerable length. The bills referred to are still with the House Committee on Patents.

Meantime bills of similar purport have been introduced and referred to the Committee on the Revision of the Laws, which appears to have been more favorably disposed toward schemes of that nature. At any rate the bill approved by this committee (H. R. No. 4419, introduced as a substitute for House bill 3767), covers the same ground as the bills of Messrs. Baker, Colerick, and others above referred to, in providing that "hereafter in any suit in any court having jurisdiction in patent cases for an alleged use or infringement of any patented article, device, process, invention, or discovery, where it shall appear that the defendant in such suit purchased the same in good faith for his own personal use from the manufacturer thereof, or from a person or firm engaged in the open sale or practical application thereof, and applied the same for and to his own use and not for sale, if the plaintiff shall recover a judgment for $5 or less as damages the court shall adjudge that he pay all costs of suit; and if the plaintiff shall not recover the sum of $20 or over the court shall adjudge him to pay all his own costs, unless it shall also appear that the defendant at the time of such purchase or practical application had knowledge or actual notice of the existence of such patent; provided that nothing contained herein shall apply to articles manufactured outside of the United States."

On February 9 Mr. Thomas, of Illinois, moved to suspend the rules and discharge the committee from the further consideration of the bill quoted, and that the bill be passed; which was done without discussion.

The alleged object of this bill is to keep farmers from being swindled by sharpers who, fraudulently pretending to own patent rights, offer to sell what they have no power to deliver, thereby making the unwary buyers liable to suits for infringement when the rightful owners of the patents come along.

It is said that actual owners of patent rights have sometimes entered into conspiracy with such swindlers, the one selling without right, the other following and collecting a second payment. Speaking of the proposed law as a remedy for such practices, the New York *Herald* says:

"Nothing but such a law—unless it be a properly handled shotgun—will dispose of the numerous sharpers that have played into each other's hands so successfully that many people, particularly farmers, are afraid to purchase patented articles of any kind. No citizen who is not a special student of Patent Office records can be expected to know anything about infringements or how to guard himself against them; therefore the power which makes the right of a patentee absolute should defend honest purchasers. A better method of defense could hardly be devised than the bill that is now awaiting further action, for the profits of sharp practice would be brought down to nothing if the wily prosecutors were compelled to pay the costs."

It is safe to say that no honest patentee would object to a law, however stringent, for the suppression of "sharpers" and "sharp practices" of the sort alleged. It is equally safe to say that the swindling practices so volubly described by the advocates of the proposed law are purely imaginary. They have no real existence—certainly not to anything like the extent pretended by those who make them a pretext for legislative interference with the property rights of patentees. We have yet to hear of the first well-authenticated case of the sort, and confidently challenge the friends of this bill to produce one. And even if there were such conspiracies, and they were as numerous as they are said to be, they would still fail to furnish any justification for this bill.

Years ago a similar swindle was practiced with horses. A man would ride into town with a handsome horse, which, on one pretext or another he would offer to sell for much less than the animal's real value. Some "innocent" buyer would pay the price and chuckle over his bargain. As soon as the seller could get well out of the way his confederate would appear in pursuit of the alleged stolen horse, prove his property, and ride on to divide the proceeds of the fraudulent sale, and repeat the trick. For a time this sort of business was a paying one. It was ultimately broken up, not by a law making purchase in good faith a bar to the rightful owner's claims, but by compelling purchasers of stolen animals to surrender them and look to the thief for the return of the money. It did not take long for men to discover the impolicy of buying horses without plentiful evidence of the seller's right to sell. Suppose that, instead of letting the evil correct itself in this legitimate way, a special law after the model of this bill had been passed; would anybody have been benefited except horse thieves and dealers in stolen horses?

In like manner, who but infringers and those who wish to use inventions without paying the inventor's royalty, would be benefited by the law proposed in this bill? To forestall a few swindlers and protect their innocent victims, is put forth as a pretext for the wholesale invasion of inventors' rights; the real purpose of the bill is as clear as the motives of the wolves in the fable, when they volunteered to stand guard over the lambs.

The great majority of patent rights rest upon inventions the products of which are individually of small cost, though of great utility and practical value. In many cases an infringer can produce and put upon the market such articles under conditions which make it next to impossible for the rightful manufacturer under the patent to find him out. The manufacturer's only recourse then is to spoil the market for such fraudulent goods by proceeding against their users. This reasonable protection is barred him by the proposed law, which makes him pay all the costs of suit, however culpable the defendant may be, when the damages do not exceed $5; and his own costs, when the damages are less than $20, except when he is able to prove that the infringer actually knew he was infringing.

Such a law substantially says to intending purchasers: "Go on; the chances are all in your favor. Buy anything that is offered without question. Ignorance is innocence. It will cost the patentee a great deal more to sue than he can get from you in damages, even if he succeeds, and the probabilities are that he will not bring suit with such heavy odds against him."

With a safe market thus made for his goods, the infringer need have no fear of success, so long as he skillfully covers his tracks.

Meanwhile the inventor, we suppose, is expected to toil on patiently, inventing for the fun of it, or because he cannot help himself; and to continue to take out patents which he can defend in the courts if he has money enough to pay his opponent's lawyers as well as his own.

Fortunately the Senate will have a word to say about such proceedings, and it is to be hoped that the friends of inventors and of just laws will lose no time in presenting the facts of this case to their senators in such a manner as may prevent in the Senate a repetition of the hasty action of the House.

The argument that people cannot be expected to know anything about patent infringements, and therefore should be protected in their unwarranted purchases of patented articles and processes, is pure childishness. No man can be expected to know the owner of every horse in the United States; but he can be and is expected to find out whether the would-be seller of any horse he wants to buy has a legal right to sell. If he does not take that trouble, the risk should be his and not that of the real owner, in case the horse has been stolen.

No man can be expected to know all the bonds and other papers of value that have been lost or stolen; but every man is expected not to buy such property without a sufficient guarantee that the seller came honestly thereby. To pass a law shielding men from loss in case they violate this plain rule of trade would simply put stolen bonds on the same footing in the markets as honest property, and remove the chief disadvantage which burglars and pickpockets labor under. They would heartily approve of such a law, no doubt, and so would all dealers in stolen property; but how would it suit the honest owners of financial paper?

If such a law would favor the dishonest and react injuriously upon the honest when applied to horses, or bonds, or any other form of property liable to be misappropriated, it would be not less unjust and mischievous when applied to patent rights.

Besides, the proposed law is open to the objection of being unnecessary. If we mistake not, there are already in force laws against conspiracy to defraud, whether the means employed are patent rights or anything else, quite sufficient to deal with the swindlers whose operations furnish a pretext for a new law. There would, however, be no occasion even to appeal to such laws, if men would simply learn not to buy anything from unknown and irresponsible parties.

But, as we have intimated again and again, the ostensible object of this bill is not its real object. Its actual purpose is so to hamper the patentee in the defense of his rights as to make it impossible for him to sustain them in connection with any article of small cost and general utility that farmers and others wish to use without payment of royalty.

In addition to its needlessness and injustice, the law proposed is open to the serious objection that it is a special law, designed to affect a limited range of persons and cases. If we must have a law of the kind, let it be a general law, applicable to all departments of trade. Such a law might run somewhat as follows:

"Hereafter, in any suit brought in any court for the collection of lawful debts, or for the recovery of the value of goods sold, or for the recovery of damages for the felonious procurement, possession, or use of any description of property unlawfully held or used by another, if the plaintiff shall not recover a judgment for $5 or less, the court shall adjudge that he pay all the costs of the suit; and if the plaintiff shall not recover the sum of $20 or over, the court shall adjudge him to pay all his own costs; provided that nothing contained herein shall apply to articles manufactured outside the United States."

It is respectfully suggested that the foregoing, or something of like effect, be submitted as a substitute for, or amendment of, the more limited bill (H. R. No. 4,419), which has come up to the Senate for consideration.

FLOUR VS. BRAN.

At a recent meeting of the National Association of British and Irish Millers held in London, a most interesting discussion took place relative to the comparative merits of what was styled the "old school" system of making flour and the new methods now being so largely adopted. There was a large attendance of the leading millers of the United King-

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dom, and the milling industry of England, which has heretofore been conspicuous for its slow-going conservative qualities, seems at last to have awakened to the fact that "flour is manufactured of a highly superior quality by other nations," which is finding its way there "in quantities that threaten to exercise a depressing influence" upon their business.

It was generally conceded that the idea of the "brown bread" school, that flour was more nutritious when it contained a portion of the bran, was erroneous, for while the bran might have, in some cases, a beneficial effect medicinally as a laxative, it lessened the nutritive power of flour in the exact proportion in which it was present. How, then, to make the best flour—how best to "divide the flour portions of the wheat berry as completely and distinctly as possible from the offal"—is the question which the English millers find foreign competition now forces them to give more attention to. The different methods of milling were compared, and various arguments urged as to their relative merits, but the principal question seemed to be as to the advisability of substituting milling by rollers made of chilled cast iron, for the old way of grinding by millstones, either wholly or partially. Many other points were discussed, but the principal interest of the meeting centered around this one question. Diagrams were shown upon the wall of the hall where the meeting was held illustrating the roller mill, which squeezes flat the kernels of wheat, from which the flour bursts out, without spoiling the bran, while it was claimed that heavy millstones operated more by friction than by pressure, tearing, rubbing, and fretting the grain, giving, even with the greatest care, a large mixture of bran dust with the flour, and so fine that it could never afterward be thoroughly separated from it. Notwithstanding there were many millers present who had large amounts of money invested in the making of flour by the old millstone process, and there was an evident reluctance to acknowledge the great superiority of the flour milled by rollers, numerous specimens of each of which were presented for examination, the general sentiment seemed to be in favor of the adoption of the new process, although there were many who manifested a disposition to oppose it step by step, and who will only give way as the better brands of flour, with the smallest proportion of bran and woody substance, drive out the inferior grades.

The thorough cleaning of the wheat before milling was also put forward as a most important essential in the making of the highest grade of flour, and for this purpose the American Brush machine was highly spoken of. One speaker said that the American theory was that a light cleaning was sufficient, which he thought was not correct, "as it is by no means a light treatment which the wheat is subjected to in passing between the stones in the operation of grinding." Therefore, he argued, "as much of the outside of the wheat as can be proved by examination of the bran is at present ground off by millstones should, if possible, be removed while it can be kept by itself," and one of the wants of the future in the milling business was a machine which would make the outside of the wheat, before passing through the stones, resemble the outside of the bran as it now comes from the stones. This, it was claimed, would prevent a good deal of bran dust from becoming a part of the flour, and tend to the making of that perfect article when all the flour might be put into one sack and the offal into another, or "the complete separation of every particle of flour from every particle of the other constituents of the wheat."

The American International Exhibition of Milling Machinery and Mill Products, to be held at Cincinnati, in June next, in connection with the annual fair of that city, was referred to at length by several of the speakers, and the hope was expressed that there would be general participation, especially as arrangements had been made whereby machinery might be entered for exhibition without any payment of duties.

A NEW GOVERNMENT BUREAU PROPOSED.

A bill to create a Department of Manufactures, Mechanics, and Mines has been introduced in the House of Representatives. The duty prescribed for the new bureau is to collect information concerning the manufacturing, mechanical, and mining industries of the country; to secure information as to the condition of the producing classes, especially as to their wages and cost of living as compared with the value of their productions, and to investigate the moral, social, educational, and sanitary condition of mechanics and laborers, and as to the causes that may operate injudiciously upon these conditions; to collect statistics of the leading manufactures of the several States, the amount of capital invested, value of raw material used, wages paid, value of produce, and number of persons employed; also, to secure information as to the location of the mineral lands, the number of persons employed, and quantities of minerals produced. The department is to be under a commissioner of manufactures, mechanics, and mines, to be appointed by the President for four years, upon a salary of $4,000, with a chief clerk, upon a salary of $2,500 per annum, and as many clerks as may be necessary, at salaries in no case exceeding $1,500 per annum.

Wisely planned and administered such a department might be of great benefit to the industries of the country, and would furnish a proper complement to the Departments of Education and Agriculture, also assuming them to be wisely administered. In a country like ours, education, agriculture, manufactures, and mining involve interests of infinitely greater importance than those which fall under the jurisdiction of the Army and Navy Departments. And, though it is no part of the business of the government to interfere in either of these great lines of individual effort—and such interference should not be tolerated—it is still possible for a central bureau to be of great service in collecting and disseminating exact information with respect to their condition and needs.

There is a serious risk, however, that the new bureau might be anything but beneficial. In the hands of an incompetent commissioner it might simply pile up antiquated, inaccurate, and useless statistics, as has been done to a wearisome extent by the Commissioners of Education and Agriculture, especially the former, or it might fall into worse hands and be wholly prostituted to partisan ends. Besides the educational, moral, social, and sanitary condition of mechanics and laborers is no more in need of official investigation than the corresponding condition of merchants, lawyers, clergymen, politicians, or any other portions of the community. The ill success of the late Labor Committee, in its efforts to gather information with regard to the industrial affairs of the country, illustrates only too clearly the probable value of the information which the proposed department would collect when administered for partisan purposes.

On the other hand, it is quite conceivable that the new bureau might be, in each and all of the several fields of inquiry prescribed for it, as successful as the Massachusetts Labor Bureau has been in investigating the industrial interests of that State. In such case its benefits would be incalculable.

THE PREVENTION OF FIRES.

There is nothing which can be said under this head which does not receive the close attention of all officers of fire insurance companies. They have the most direct and powerful motives to impel them to obtain and publish every scrap of information which will in any way tend to make fires less frequent, and will lessen their destructiveness when they do occur. The fire insurance companies now control such a vast amount of capital, and have such an army of experts in their employ, that there is very little which is presented in their line that does not meet with the most exhaustive examination, and the rates charged on risks are varied according to their judgment as formed on many and widely different grounds. The mutual system of insurance, started among the cotton goods manufacturers of the Eastern States in 1835, first gave the great impetus to this method of particular discrimination, as, where every one insured was thereby made to a proportionate extent his own insurer, and correspondingly interested in the safety of all other property in the same company, there was every motive to see that all possible provision should be made against loss by fire, and each risk should be closely valued.

Among the subjects which have particularly engaged the attention of the mutual companies, and in regard to which all the other companies quickly followed their example, were the building, arrangement, and location of buildings to be used for factory purposes. A leading president of a mutual insurance company in Boston the other day remarked that every one now knew in what a model factory consisted, so far as the question of insurance was concerned; the floor beams must be far apart, instead of close together, and covered with three inch plank for flooring; where the beams were let into the wall they must be rounded on the top corner and the bricks laid on loose, so that in case of fire they would drop out without pulling the wall down; the roof must be nearly flat, and everything else in the general plan after such a calculation as would give the firemen ready access, in case of fire, to every part of the structure. In addition to this, such parts of the work as are supposed to be especially dangerous are often placed in separate buildings; the picker room in cotton factories is generally so provided for, and water pipes are so disposed as to make it comparatively easy to flood such apartments at an instant's notice. In tanneries and leather factories the bark grinding is generally done at a distance from where the drying lofts are, as well as from where the stocks of bark are stored, and so, with every industry, care is taken, as far as possible, to isolate those parts of the business in which fire would most readily happen, or where it would be most destructive if it did occur.

Another matter which has attracted considerable attention from the insurance companies has been the various kinds of hose in use for fire engines. Until a comparatively recent date nothing was considered quite as good as leather hose; but it may now be safely said, that while there is annually a great increase in the total amount of fire-hose used in the country, there is no increase in the amount of such hose manufactured from leather. With good care leather hose will probably outwear any other variety, but it requires a vast amount of attention, and some little amount of experience for a proper understanding of how it should be treated, while that made of rubber, or linen, or cotton, rubber lined, involves no such labor. Many varieties of the latter, also, will withstand a much higher pressure before bursting than leather can be successfully subjected to. At a trial which was made in December last, before some inspectors of a mutual fire insurance company, it was found that one sample of 6-ply cotton rubber-lined hose, weighing twenty ounces to the foot, withstood a pressure of over 1,100 pounds to the square inch, while similar hose weighing eight to twelve ounces to the foot withstood a pressure of from 300 to 500 pounds to the inch. The fact, however, that the officers of insurance companies, who are in a comparatively independent position, as related to the different manufacturers of hose, are taking the initiative in such trials, and have a strong interest in seeing that the best and most reliable article is everywhere employed, proves a great stimulus to the manufacturers, and has provoked a rivalry which cannot fail to be of benefit to the public generally.

CHASTANT'S OBSERVATIONS ON YELLOW FEVER.

Dr. Alcée Chastant, of New Orleans, takes strong ground against the germ theory of the origin of yellow fever. All investigations to discover the manner of its introduction into the large cities of Europe and the United States have failed, he says, with all the experience so far had, to establish definitely the real origin of the disease. Unless the microscope shall ultimately prove the contrary his opinion is that while the conditions which produce yellow fever can be known, the essential nature of its direct cause will ever remain a mystery. From a study of its geographical limits and its more or less irregular irruptions he thinks that its outbreaks must be some combination of meteorological and telluric conditions especially favorable to the development of the disease, such as a high temperature with dampness, conjointly with certain emanations from the earth.

Touching the character of the disease, Dr. Chastant's long experience warrants, he thinks, the opinion that each epidemic of yellow fever is of its own peculiar and special type, varying according to the locality and the influences which have been instrumental in bringing it about. The immediate cause of the disease is the introduction into the human organism of a specific inorganic poison, which has never been chemically or microscopically demonstrated, a poison which develops under the influence of heat, moisture, and other favorable circumstances.

"Yellow fever is not imported, but is most certainly endemic. When, however, climatic and telluric conditions concur, and foreign cases are existing, it then spreads and becomes epidemic." Such epidemics cannot be prevented, but can be mitigated by general sanitary measures and precautions. He agrees with the late Dr. Warren Stone, in regarding the disease to be non-contagious, but taken from the atmosphere poisoned by telluric emanations. The germ theory he regards as not only unproved, but highly improbable. On several occasions Dr. Chervin swallowed the matter of black vomit and suffered no harm. Neither did Dr. Guyon, at Martinique, from similar experiments. Dr. Firth inoculated dogs with the fresh matter, and subjected himself to the same operation. He applied the fluid to the surface of a cut made on his arm, and secured it there for two days by means of sticking plaster, and repeated the experiment above twenty times in various parts of his body. He inserted the matter in his eyes, and swallowed a large quantity of black vomit, pure and dilute, and no injurious effects ensued. Cats, dogs, and fowls were fed with it without sensible effects, and the fumes obtained by evaporating black vomit did not harm those who inhaled them. Such heroic experiments may not disprove the germ theory, but they certainly tell very strongly against it.

Sporadic cases of yellow fever, Dr. Chastant holds to be produced by natural causes, arising exclusively from the *eremacausis* which takes place in the filth of gutters, as well as on the immediate surface of the earth in certain localities, and these cases do not extend beyond the sphere of these causes. Although these natural causes, whenever they exist, help to increase the yellow fever, yet its epidemic feature arises from a more general law of the soil, the effect of which is produced by a geological *repercussive action*. Sporadic cases may precede an epidemic, but he doubts if they can produce an epidemic, unless there is a concurrence of both causes.

An Unexpected Comet.

A dispatch has been received from Dr. Gould, formerly of the Dudley Observatory, Albany, N. Y., but now director of the Cordoba Observatory, South America, stating that a great comet is in the neighborhood of the sun, passing northward. No large comet has been expected this year, and no small one at this season, Winnecke's comet not being due until near the end of this year. Reports by mail are awaited with great interest. Should Dr. Gould's dispatch be confirmed, a new member must be admitted to our cometary system; and possibly the nations north of the equator may also be treated to a sight of it.

Railroad Crossings.

Mr. James Torrance, of Troy, N. Y., proposes the following method of abolishing the danger attending the present style of railway crossings. He would use for such crossings a rail of special form, rolled in one piece of the usual length, with a groove wide enough for the flange of the car wheel to run in; the groove to be wedge-shaped and widest at the top, with plain sides, so as not to catch the feet of men or animals. In this way he would get rid of the usual trap between the planking and the rails. Such a grooved rail could easily be kept clear of snow and ice; and the extra cost of rolling would be nothing, he thinks, compared with its advantage in doing away with the risk to life and limb attending the present style of crossings.

A JOINT resolution appropriating $20,000 to enable the Commissioner of Fish and Fisheries to represent the United States at the International Fishery Exhibition to be held in Berlin next April, was adopted by the House of Representatives, February 4.

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AMERICAN INDUSTRIES, No. 32.

ROTARY PRESSURE BLOWERS.

Our large engraving represents the extensive rotary blower manufactory of Messrs. P. H. & F. M. Roots, of Connersville, Ind. These gentlemen, as many of our readers are already aware, were pioneers in this branch of industry, and were the first to introduce in this country and in Europe a successful positive blast rotary blower.

In 1860, to test thoroughly the capacity and merits of the newly-invented blower, the Messrs. Roots built two blowers, capable of melting from six to eight tons of iron per hour. These blowers were the first that were built of sufficient size for large foundries. One was placed in the large works of Miles Greenwood, Esq., Cincinnati, and the other in the stove foundry of G. W. Ball, Esq., Covington, Ky., where they were in daily use for nearly two years before others were built, melting daily from eight to twelve tons of iron. The results of these tests more than realized the most sanguine expectations of the inventors, and received the highest commendations from all who witnessed their performance, both as to economy of power and fuel and the quality of iron and castings produced. These tests were considered satisfactory and sufficient to warrant making arrangements for the manufacture of the blowers. It was soon ascertained, however, that, in order to make their manufacture a success, special tools were required, and that the business should be made a specialty, in order to bring the blowers up to the standard of first class machines. As the inventors were already receiving many orders, they decided on commencing the manufacture themselves. They purchased a small machine shop and foundry in Connersville, which they immediately enlarged, and furnished with such special tools as it was found from time to time were required to perfect their construction and increase the turn out.

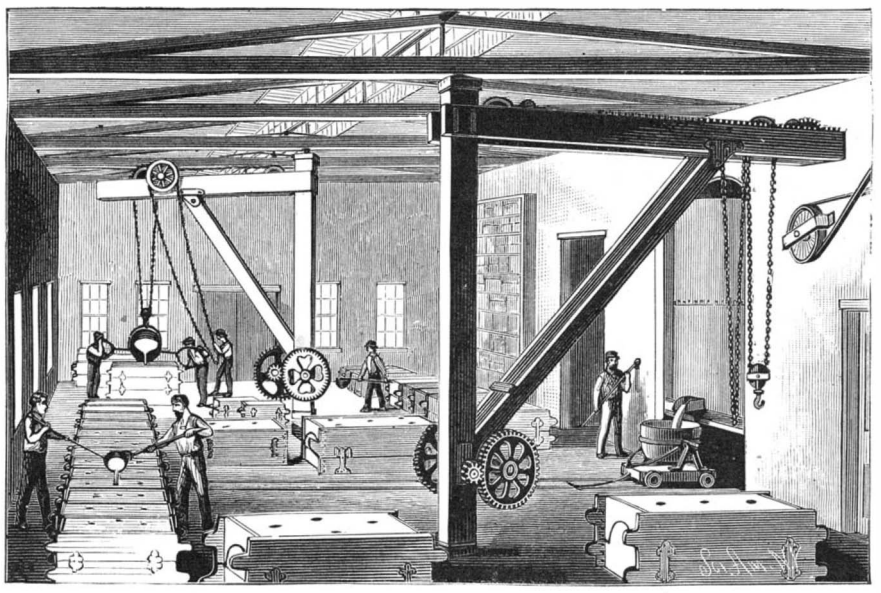
The manufacture of rotary pressure blowers was thus begun in 1863. From that date to 1873 to 1874 the works were frequently enlarged until over one hundred men were employed, and during this time orders for blowers were always in excess of the capacity of the works. The blowers were not only sold in all parts of the United States and Canada, but were sent to almost all parts of the world where machinery is used. The trade extended to the West Indies, Mexico, South America, the Sandwich Islands, Australia, the Cape of Good Hope, and elsewhere,

In Europe, patents were obtained in England and the principal countries on the continent, and arrangements were made for their manufacture in England, France, Belgium, Austria, and several places in Germany. There are already over three thousand of these blowers in use in England alone, and probably as many more on the continent, ranging in size from those capable of blowing a single blacksmith forge to those having sufficient capacity to ventilate the largest coal mines, discharging with ease 200,000 cubic feet of air per minute. They are used by such firms as the following, viz.: Sir William Armstrong & Co., Newcastle; Sir Joseph Whitworth & Co., Manchester; the Barrow Hematite Steel Co., Barrow-in-Furness; London and N. W. R. R. Co., Crewe; Messrs. Platt Bros., Oldham, and hundreds of others in England; and by Herr Krupp, at Essen, Prussia; William Hartmann & Zimmermann, Chemnitz, Saxony; Phenix Works, Ghent, Belgium; M. Sigle, Vienna, Austria; Messrs. Heilmann, Ducommun and Steinlin, Mulhouse, Alsace.

These blowers have been awarded prize medals by three International Exhibitions. At Paris, in 1867, they received the highest award given to machines of that class. At the Vienna Exhibition, Vienna, Austria, 1873, they were also awarded the highest medal for progress. At the Centennial Exhibition, held in Philadelphia, 1876, they again received the highest award for *design, workmanship, material,* and *efficiency*. They have also received numerous other medals and awards from the American Institute, New York, and from the Cincinnati Industrial Exhibition, Cincinnati, Ohio, and other exhibitions and State fairs, all of which were awarded to this blower on account of the excellence of the principles of its construction, its simplicity, and efficiency, before many of the constructive and mechanical improvements which have since been made were added, and without any of the improvements published for the first time in this article. The manufacturers justly claim that if its intrinsic excellence was so great as to merit the high awards under the circumstances mentioned, they are now much more entitled to them after the great improvements that have been made in their construction.

Some ten years since the Manhattan Gas Company, at the suggestion of Mr. Sebattan —then their chief engineer—ordered two of these machines of the largest size to be used as gas exhausters. They worked very successfully, and since that time the largest and best companies in the United States and Canada have adopted this style of exhauster. In common with all other iron manufactures, this business was seriously affected by the years of depression that followed the panic. But the works have been kept in constant operation, and have had a steady though comparatively small trade.

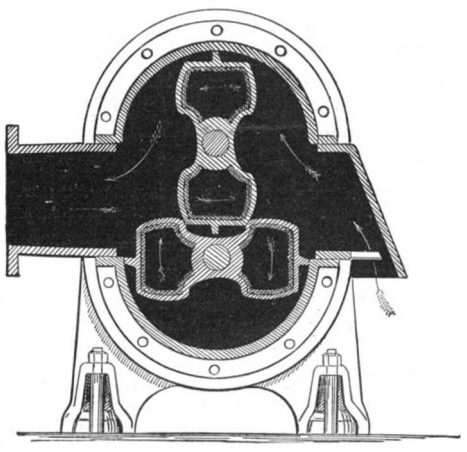
With the general revival of business this branch of industry has improved, and we are informed that to-day the Messrs. Roots have more orders than they can promptly fill, and are constantly increasing their force to meet the increased demand.



INTERIOR OF FOUNDRY.

The leisure afforded by the dull times has been improved to the utmost in perfecting all the constructive details of the blower, and bringing it up to the highest standard of mechanical perfection, till in these directions it seems impossible to make further improvements.

These improvements have simplified and reduced the number of parts of the blower, both external and internal. As now constructed, the internal operating parts of these blowers consist simply of two iron revolvers, each cast entire in one piece. There are no bolts, nuts, screws, washers, or other internal parts that can by any possibility get loose and require adjustment or cause injury. These revolvers are perfectly balanced, and this is a very important point, as they will bear much higher speed than unbalanced ones; for this reason a much smaller blower will do a given amount of work, and at a greatly reduced cost.



SECTION OF BLOWER.

The parts coming in contact and requiring to be finished have been reduced to less than a fourth of that required formerly, by which the friction of the parts passing each other has been greatly reduced, and iron revolvers can be made at much less cost. As no wood is used in the construction of the blower, all danger of shrinking or swelling of any of the parts is entirely obviated, and the parts can be made to run in close contact, and damp or dry, hot or cold air, or dust, can be passed through the blower without injury.

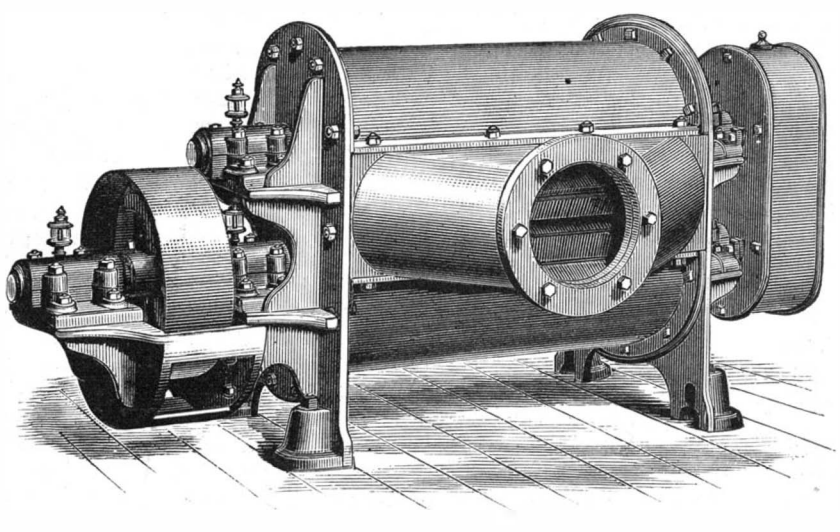
Externally the blower has been very much simplified and improved. Only two gears and one driving pulley are now used. The gears are cut in the most perfect manner, and are inclosed in iron housing and perfectly protected from dust and accident. The driving pulley has a large belt surface, and the blower can be driven under high pressure with a loose belt. The driving shaft is provided with a bearing outside the driving pulley, which is rigidly attached to the blower. This gives double bearing surface to the driving shaft, compensating for the stress of the belt. The shafts are of steel; the journal boxes are of the best known construction, and are so arranged that when the bearings, which are of phosphor or carbon bronze, are adjusted or renewed, the shafts will be brought exactly into their original position. The attachments are very easy and simple. As the speed is slow the blower can be run directly from the main line of shafting, dispensing with counter shafts, etc. As the discharge pipe comes out horizontally from the blower, one quarter-turn will carry it in any direction.

We have been thus explicit in giving the history of the growth of this industry, as it is a notable example of the healthy development of a valuable invention. From a small beginning it has expanded until it is known all over the world.

The works, which are in many respects unlike anything else in this country, are well represented by the engravings. The small vignette in the larger engraving gives a view of the exterior of the works, while above it is represented the room where the blower cases are bored and fitted, and where much of the larger and heavier work is done. The shafts and revolvers are turned, and the gear wheels are bored and cut, in the department represented by the central figure. All of the finished parts are brought into the large room shown in the lower view, to be put together to form the completed machine. The small view on this page represents the interior of the foundry, and the improved blower is also represented on this page in perspective and in vertical transverse section.

It will be observed by an examination of the internal part of the blower, as shown in these engravings, that it does not operate at all on the principle of a fan, that is, by imparting momentum to the air by running at a great velocity, but by a regular displacement of the air at each revolution, whether it runs fast or slow. When the air enters the case at the opening for induction, and is closed in by the wings of the revolvers, it is absolutely confined, and positively forced forward until brought to the eduction pipe, where it must be discharged or the machine stop if perfectly tight, as there can be no backward escapement of the air after it once enters the case, the contact being kept up at all times in the center of the blower between the pistons or revolvers, thus preventing any escape of the air in that direction. The advantages of a positive blower of this kind will be readily admitted by any one competent to compare it with other forms.

Mr. S. S. Townsend, 6 Cortlandt street and 8 Dey street, is general agent for the manufacturers of these blowers. Wm. Cooke, of 6 Cortlandt street, and James Beggs & Co., 8 Dey street, New York City, are selling agents.



IMPROVED POSITIVE BLOWER.

Crystallized Chlorophyl.

The following note by Mr. A. Gautier, on the method of obtaining pure crystallized chlorophyl, has been communicated to the Academy, and was read at a late meeting of the French Photographic Society, in consequence of its having been shown by MM. Becquerel, Cros, and Ducos du Hauron, that that substance, when added to a sensitive film, enabled the latter to reproduce colors hitherto considered out of the reach of photography:

"To obtain the chlorophyl I take the green leaves of spinach, cress, etc., and pound them in a mortar, adding to the pulp a little carbonate of soda until the liquid is neutralized, and then I submit the whole to strong pressure. The mass thus obtained I digest in alcohol of 55° C., and I again pass it through the press; then I digest it once more in alcohol of 83° C. By this process the chlorophyl is dissolved, along with all the fats, the wax, and the coloring matters. To separate these, the liquid is filtered, and then placed in contact with powdered animal charcoal previously well washed and raised to a high temperature. At the end of four or five days the liquid will be found to have turned a greenish or brownish yellow, and it will contain all the impurities. It is decanted off, and the charcoal is collected in a tube plugged with cotton wool, where it is washed with alcohol at 65° C. This liquid takes up the yellow crystallizable substance which is always found to accompany chlorophyl, and which seems to have some intimate relation with it. On the char-

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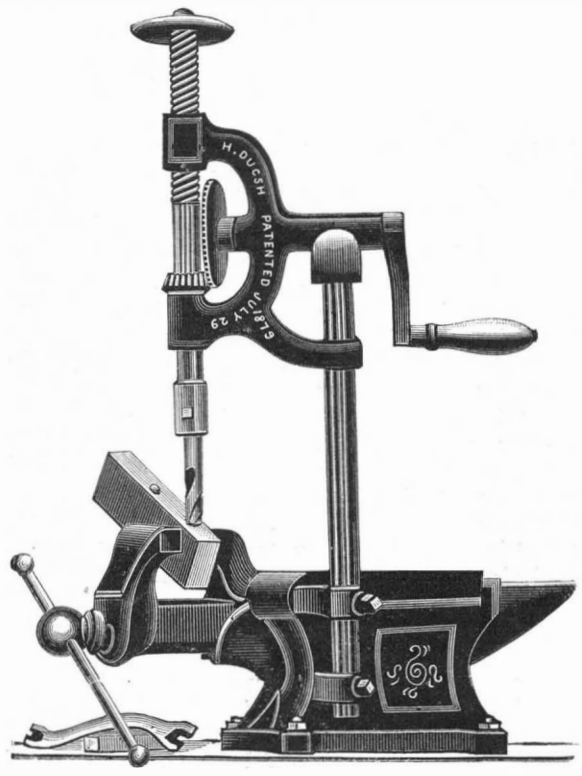
coal thus deprived of the yellow substance, or containing mere traces of it, there is poured anhydrous ether, or, better still, light petroleum oil, which does not dissolve the yellow substance. Those solvents take up the chlorophyl, and yield a deep green liquid, from which the latter can be crystallized out by slow evaporation in the dark."

NEW VISE AND ANVIL DRILL.

We give herewith an engraving of a combination tool of great utility, made by the Miller's Falls Company, of Miller's Falls, Mass., and 74 Chambers street, New York city. With this tool the work can be held in the jaws of the vise in any desirable position, and a hole may be drilled either straight or at any required angle. It seems well adapted to the work of machinists and all other mechanics working in metals. It is fastened on a bench like an ordinary vise, as shown in the engraving. The drill press can be removed in an instant when the vise or anvil is wanted separately.



VISE AND ANVIL DRILL.

This combination tool is capable of a wide range of application in various kinds of iron and steel hand work. It is well made in all its parts, and only the best materials are used in its construction. The shaft to which the drill press is fastened and the spindle are both made of steel. Each machine is furnished with a chuck capable of holding drills from half an inch down.

A Supposed Unseen Outer Planet.

In a paper communicated lately to *La Nature*, M. Flammarion shows reason for supposing that probably a planet exterior to Neptune has been the determining cause of the orbit of the comet of 1862 (which has been surely determined), and describes its course round the sun, about the distance of the aphelion of this comet, and of the classical stream of meteors of the month of August. (It is known that Leverrier attributed to Uranus the introduction into our system of the stream of November meteors, and supposed the perturbation to have occurred in the year 126 of our era.)

ELECTRICAL PRESSURE INDICATOR.

The annexed engraving represents an improved pressure temperature indicator, designed to serve the very important office of indicating maximum and minimum pressures and temperatures. The importance of this class of inventions must be acknowledged by engineers, superintendents, and others who are required to give daily attention to these matters.

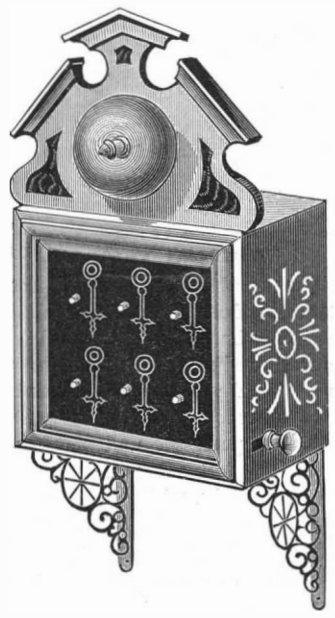
In all operations pertaining to the use of pressure or temperatures, there is generally some considerable range of pressure or temperature not in any way injurious; but extremes of high or low pressure or temperature are to be avoided for obvious reasons. If the pressure is too low, work is delayed and in some cases goods are injured. In either case loss will ensue; while, if the pressure run to the other extreme, it may reach a point where rupture must result. To avoid these extremes, the ordinary instruments indicating the pressures or temperatures are required to be carefully watched by the attendant, a duty that is sure to become wearisome in time, with a possibility of neglect at an important moment. Disaster is too often traceable to inattention of this kind.

The indicator shown in the engraving is a faithful servant, standing sleeplessly on guard day and night, ready to give warning when the extreme of either high or low pressure is approached by ringing a small bell placed in any room however distant, within hearing of the operator, thus enabling the attendant to perform other duties with an assurance that he will receive prompt notice of any considerable variation of pressure or temperature. When the device is to be used for indicating pressure it is attached to any of the ordinary spring pressure gauges, and when used to indicate temperatures it is connected with a pyrometer.

The device shown in Fig. 1 represents an ordinary spring pressure gauge, on the spindle of which is secured a crank arm, A, with a projecting crank pin on its outer end; the glass front of the gauge is bored for the reception of a post that has double washers on the opposite side of the glass to which pins, B and C, are attached. The washers turn upon a central screw in the post, enabling the pins, B and C, to be moved and secured in any desired position around the center of the post. A wire connects the central post with the batteries, passing in the circuit through a switch, D, and bell, E, back to the gauge.

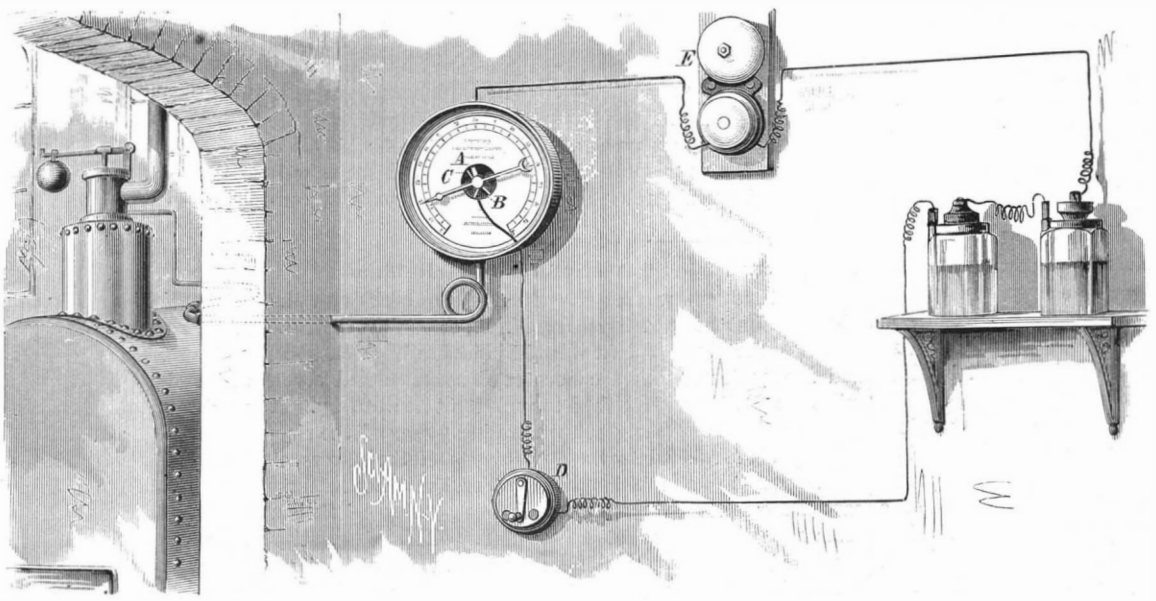
The electrical circuit is completed or broken automatically by the rotation of crank arm, A, which coming into contact with the pin, C, completes the electric circuit, and rings the bell, E. This bell may be placed at any distance from the instrument, and will indicate the minimum pressure. A reverse movement of the spindle brings crank arm, A, into contact with pin, B, indicating the maximum pressure. An alarm at either extreme signifies that the attention of the attendant is now required. The switch, D, is provided to admit of disconnecting the electrical indicator whenever desired. This is found necessary when the device is used in connection with water tanks, reservoirs, etc., to prevent the bell ringing after the proper attention has been given.

In cases where it is desired to connect a number of boilers or tanks to one bell, a device not unlike a hotel annunciator is used (Fig. 2). The bell rings at the proper time, and the needle point shows the location of the boiler that requires attention.



SHAW'S PRESSURE ANNUNCIATOR.

This appliance is adapted to all kinds of spring gauges, and to Shaw's standard mercury gauges. The batteries employed are reliable, requiring only a little water to supply waste of evaporation once in the course of two or three months, and about once a year a few crystals of sal ammoniac are to be added.



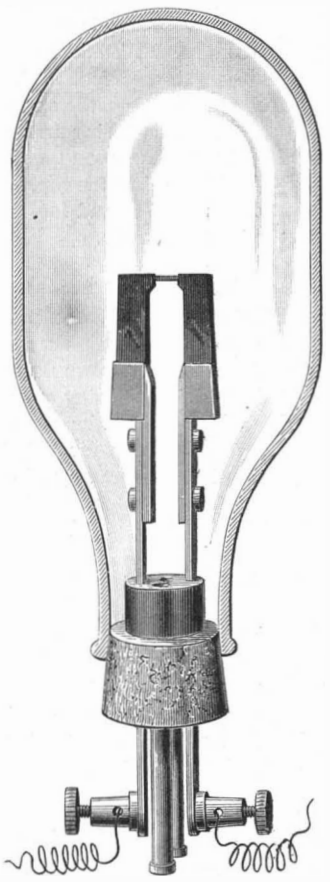
SHAW'S ELECTRICAL INDICATOR.

In large works the electric bell may be placed in the office or any part of the building, and will give instant notice if steam is too low to perform work, or so high that it is dangerous. The device seems capable of a great variety of applications, and will undoubtedly prove a watchful, faithful, and inexpensive servant.

For further particulars address the patentee, Mr. Thos. Shaw, at steam gauge warerooms, 915 Ridge Avenue, Philadelphia, Pa.

IMPROVED ELECTRIC LAMP.

We give herewith an engraving of an electric lamp patented by the well known electrical inventor, Mr. Moses G. Farmer, of Newport, R. I. A globe made of glass, and having an air-tight stopper fitted to its lower end, contains a small bar of carbon supported by two large blocks of the same material, mounted on the ends of two bars of metal extending downward through the stopper, and provided with binding posts for receiving the wires from an electrical generator. Two small tubes enter the globe through the stopper, for the purpose of substituting for the common air contained in the globe a vacuum or an atmosphere of some suitable gas. The small carbon rod offers great resistance to the passage of the electrical current, and is consequently heated to incandescence, and produces a brilliant light without consuming either itself or the gas contained in the globe.



FARMER'S ELECTRIC LAMP.

The Harnessing of Electricity.

Mr. W. H. Barlow, the new president of the Institution of Civil Engineers, London, in his recent inaugural address, speaking of the rapid growth of telegraphy and other practical applications of electricity, said that the diminution of power, from increased length of the conducting wire, had been surmounted by relays of power at fixed stations. (This was the discovery of Morse.) By employing this ingenious expedient on the Indo-European Telegraph, Calcutta had frequently been put in direct communication with London, a distance of 7,000 miles.

He further stated that Dr. C. W. Siemens had ascertained that, including all sources of loss, 50 per cent of the original power could be realized by electric wires at a distance of one mile from the motor; and that with adequate provisions against heating it would be no dearer to transmit electromotive power to a greater than to a smaller distance. Sir William Armstrong, by means of an electro machine and wire works his circular saw at a distance of a mile from the water wheel that turns the electric machine. By the same means Dr. Werner Siemens works a locomotive that carried thirty persons.

ENGINEERING INVENTIONS.

Mr. James A. Stout, of Belleville, Ill., has patented a traction engine in which the propelling power is applied directly to an adjustable front axle, and the axle is provided with a universal or ball joint motion. The boiler is of novel construction and designed with a view to economy and safety.

An improved rock drill, patented by Mr. John Brown, of Ishpeming, Mich., is so constructed that the piston and tool may be rotated by the entering air or steam, and that the entrance and exit of the air or steam will be controlled by the movements of the piston.

Mr. James E. Purdy, of Tallahassee, Fla., has patented a means for connecting cars, which is so constructed that the cars will couple themselves when run together, and will not be liable to become accidentally uncoupled.

Mr. James Morton, of Philadelphia, Pa., has patented

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a hydraulic engine of peculiar construction for converting into mechanical power and motion the pressure of a column of water.

A wheel guard for railway cars, patented by Mr. Salomon Brisac, of New York city, is designed to prevent injury to persons who may accidentally fall in front of car wheels, and also to prevent the car wheels from coming in contact with obstructions on the track.

Mr. Orlando H. Jadwin, of New York city, has patented an improvement in the system of car propelling, in which an endless cable of wire rope is made to travel over a given route by the action of stationary engines, and the cars or other bodies are either connected to the cable to be drawn along by it, or are disconnected from it, by means of a clutch affixed to the car. The invention consists in this clutch or tension device, which is loosely connected with the car and formed of three principal parts—a pulley, a foot for holding the rope to the pulley, and a brake upon the opposite side of the pulley from the foot—these parts being arranged in such relation that a pressure of the brake upon the periphery of the pulley projects the pulley against the rope, and gradually clamps the same between the pulley and foot until the car attains the speed of the traveling cable.

Determination of Carbonic Acid in the Atmosphere.

The amount of carbonic acid in the atmosphere out-of-doors varies but little from day to day and from year to year. In-doors it is quite otherwise. In winter we close the windows to keep out the cold air, and in so doing prevent the exit of the impure air poisoned by combustion of coal in the stoves and oil in our lamps, as well as the exhaled effluvia of the breath. To determine the quantity of carbonic acid in a church, school, or theater is a guide in judging of the success or failure of its ventilation. The usual method consists in drawing a measured quantity of such air through baryta solution and weighing the precipitated carbonate.

Kapusstin has described a quicker and easier method, dependent upon the fact that 70 per cent alcohol will not dissolve carbonate of soda, while dilute alcohol will do so.

He dissolves ½ gramme of caustic soda in 1 liter of alcohol. He pours 75 c.c. of this solution into a 5 liter bottle full of the air to be tested, shakes it for half an hour, and pours it out, stirs it well, and draws off 25 c.c. of the turbid liquid. To this he adds water from a burette until the turbidity, due to undissolved carbonate of sodium, disappears, and multiplies the amount of the water by three. The following formula now gives the number of cubic centimeters (x) of carbonic acid at normal temperature and pressure contained in 5 liters of air, when n is the number of cubic centimeters of water necessary to dissolve the carbonate of sodium:

$$x = \frac{n - 6{\cdot}5}{0{\cdot}55}$$

This method is specially recommended for sanitary purposes, as the number of determinations made can be very large.

Oxalic Acid and its Salts.

BY DR. J. SCHNAUSS.

Oxalic acid is found pretty abundantly in the juices of plants in combination with calcium and potassium, and in the latter case in the form of acid salt of potassium. The juice of *Rumex acetosa*, *Oxalis acetosella*, and other similar plants, all contain this substance.

This acid oxalate of potassium is soluble with difficulty in cold water, on account of the property it possesses of dissolving ferrous salts almost to as great an extent as oxalic acid itself; it is used for removing ink and iron-mould spots. Oxalic acid can be prepared from this salt, as also from sugar, by oxidizing it with nitric acid. Of late years it has been obtained from sawdust, by heating that substance with sodium carbonate in the form of hydrous acicular crystals ($C_2H_2O_2+2H_2O$). It can be easily deprived of its water of crystallization, and this anhydrous acid is said to be capable of sublimation undecomposed; but if the hydrate be heated quickly in closed vessels it decomposes into carbonic oxide, carbonic anhydride, and formic acid. Heated with concentrated sulphuric acid (H_2SO_4) it separates into equal parts of carbonic acid gas and carbonic oxide.

In photography, oxalic acid is employed on account of its property of reducing the salts of the precious metals in the presence of light and heat, and also of readily dissolving the salts of iron, which are otherwise insoluble in water, even when in combination with a base. In the latter case the corresponding double salt is formed. The acid is often used as a reducing agent for the salts of silver; and it may be also so employed for those of gold, instead of the generally recommended iron sulphate. Recently oxalic acid, in combination with iron and potassium, has been employed for developing gelatine emulsion plates; it has been applied also to photometry, by Van Monckhoven, in combination with uranium, and by Eder in combination with mercury.

The uranium and mercury oxalates owe their employment for photometrical purposes to the fact that, when exposed to the sunlight, they are immediately decomposed, and give off carbonic acid gas, which, by means of a simple apparatus, can be made to raise a column of fluid in a small graduated tube. In this case, however, the pressure of the fluid column and the absorption of the gas must be taken into consideration or eliminated.

Of the less known oxalates, perhaps the most interesting is the double oxalate of iron and manganese. It can be easily prepared by nearly saturating acid oxalate of ammonia (or the neutral salt, acidulated with free oxalic acid) with hydric peroxide of manganese (MnO_2+H_2O), the operation must be effected in the dark. A solution of a splendid red color is formed, which, brought into the clear light of day, almost instantaneously loses its color with violent effervescence.

The hydric oxide of manganese required for this reaction may be prepared by precipitation from a solution of manganese sulphate ($MnSO_4$) by means of the so-called *Eau de Javelle*, a solution of sodium hypochlorite ($NaClO$) rendered alkaline by the addition of a slight quantity of sodium hydroxide. This black precipitate is well washed on the filter or by decantation, and then dissolved in acid ammonium oxalate.

Very sensitive is a piece of filter paper dipped in a mixture of permanganate of potash ($KMnO_4$) and oxalic acid—of course prepared in the dark. When exposed to direct sunlight, decomposition ensues instantaneously; even in the dark the red color is only permanent for a few minutes. If a solution of copper sulphate be mixed with one of ammonia oxalate of iron, and a glass vessel full of the mixture be set in the sun, the side of the vessel which is towards the sun will be coated with metallic copper. This reduction does not take place in the dark. Nevertheless, it is a question whether it be due to the direct action of light on the oxalate of copper that is formed; probably ferro-oxalate is first formed, and this, by loss of oxygen, is converted into ferri-oxalate.—*Photo. News.*

The Value of the Diamond Drill.

Mr. A. J. Severance, of San Francisco, says that the diamond drill has played a very important part in developing the mineral wealth of the West. The first great treasure house which these drills opened up was that known as the Consolidated Virginia and the California Bonanzas, which have yielded $107,000,000, of which the stockholders have received $74,000,000 in dividends. One of the owners of the mines told Mr. Severance that the diamond drill had realized for him $5,000,000. All of the principal Comstock mines, and many of the largest mining properties located in California and Nevada, use these drills. They are also extensively used in Colorado; have pushed their way to most of the Territories; have been introduced and operated in New Mexico, old Mexico, and Australia. The Japanese Government has also been supplied with them.

Mr. Severance enjoys the distinction of having perfected the diamond drill, and of proving its utility by running a horizontal hole (then regarded an impossibility) eight hundred feet, taking out a complete cylindrical core, and showing the strata of every inch of rock passed through. This was done in Vermont. Soon after he introduced the drill upon the Pacific coast, with the results already noted.

Artificial Vanilline.

Whenever the synthetical chemist produces any well known substance artificially it meets with more or less opposition from persons who are not convinced that it is identical with the natural product. The *Badische Gewerbe Zeitung* publishes for artificial vanilline the following indorsement from Prof. Meidinger:

Artificial vanilline possesses undeniable advantages over natural vanilla. The latter loses its aroma easily and frequently spoils completely, while the former can be kept for any desirable length of time without the slightest change in quality. The activity of vanilla is very unequal, as the percentage of vanilline in the beans varies; hence a uniform flavor can only be obtained by the use of vanilline. The vanilla bean contains only 2 per cent of valuable material, with 98 per cent or more of worthless or even injurious matter, coloring and resinous, the removal of which is troublesome and tedious, before the pure flavor can be obtained. Cases of illness that occasionally follow the use of vanilla ices are probably referable to such impurities extracted from the bean itself.

In Germany the vanilline is mixed with sugar and put up in packages of different strength for different purposes. That prepared for chocolate manufacturers is 70 times as strong as good vanilla, or 50 times the strength of the finest vanilla. That intended for family use is put up in packages equal to one bean, and sold at 9 cents each. The vanilla essence for liqueur manufacturers contains 2 per cent of vanilline, and 2 grammes will flavor 1 liter of the liquor employed.

Dr. Meidinger has used artificial vanilline in his own house, and is able to speak from personal experience as well as from a chemical knowledge of its preparation and constitution.

Penetrative Power of the Electric Light.

Some time ago we mentioned an experiment with the Maxium light made at Saratoga, N. Y., to test the distance at which the electric light would illuminate a given spot, and it was found that a concentrated beam carried seven miles (to Ballston) furnished enough light to read by. A more crucial test of the great penetrating power of the electric light is furnished by the experiments of the officers of the French-Algerian Triangulation Service, who recently saw the electric light from the Spanish station of Zetica, from a distance of more than 164 miles. This observation is proof, if proof were wanted, of the great value of the light for maritime purposes, when it is exhibited from sufficiently elevated positions.

Cements.

Quite as much depends upon the manner in which a cement is used as upon the cement itself. The best cement that ever was compounded would prove entirely worthless if improperly applied. The following rules, says the *Druggists Circular*, must be rigorously adhered to if success would be secured:

1. Bring the cement into intimate contact with the surfaces to be united. This is best done by heating the pieces to be joined in those cases where the cement is melted by heat, as in using resin, shellac, marine glue, etc. Where solutions are used, the cement must be well rubbed into the surfaces, either with a soft brush (as in the case of porcelain or glass), or by rubbing the two surfaces together (as in making a glue joint between two pieces of wood).

2. As little cement as possible should be allowed to remain between the united surfaces. To secure this the cement should be as liquid as possible (thoroughly melted if used with heat), and the surfaces should be pressed closely into contact (by screws, weights, wedges, or cords) until the cement has hardened.

3. Plenty of time should be allowed for the cement to dry or harden, and this is particularly the case in *oil* cements, such as copal varnish, boiled oil, white lead, etc. When two surfaces, each half an inch across, are joined by means of a layer of white lead placed between them, six months may elapse before the cement in the middle of the joint has become hard. In such cases a few days or weeks are of no account; at the end of a month the joint will be weak and easily separated, while at the end of two or three years it may be so firm that the material will part anywhere else than at the joint. Hence when the article is to be used immediately, the only safe cements are those which are liquefied by heat and which become hard when cold. A joint made with marine glue is firm an hour after it has been made. Next to cements that are liquefied by heat are those which consist of substances dissolved in water or alcohol. A glue joint sets firmly in twenty-four hours; a joint made with shellac varnish becomes dry in two or three days. Oil cements, which do not dry by evaporation, but harden by oxidation (boiled oil, white lead, red lead, etc, etc.) are the slowest of all.

Aquarium Cement.—Litharge, fine, white, dry sand, and plaster of Paris, each 1 gill; finely pulverized resin, 1-3 gill. Mix thoroughly and make into a paste with boiled linseed oil to which drier has been added. Beat it well, and let it stand four or five hours before using it. After it has stood for 15 hours, however, it loses its strength. Glass cemented into its frame with this cement is good for either salt or fresh water. It has been used at the Zoological Gardens, London, with great success. It might be useful for constructing tanks for other purposes or for stopping leaks.

Casein Mucilage.—Take the curd of skim milk (carefully freed from cream or oil), wash it thoroughly, and dissolve it to saturation in a cold concentrated solution of borax. This mucilage keeps well, and as regards adhesive power far surpasses the mucilage of gum arabic.

Casein and Soluble Glass.—Casein dissolved in soluble silicate of soda or potassa makes a very strong cement for glass or porcelain.

Cheese Cement for Mending China, etc.—Take skim milk cheese, cut it in slices and boil it in water. Wash it in cold water and knead it in warm water several times. Place it warm on a levigating stone and knead it with quicklime. It will join marble, stone, or earthenware so that the joining is scarcely to be discovered.

Chinese Cement (Schio-liao).—To three parts of fresh beaten blood are added four parts of slaked lime and a little alum; a thin, pasty mass is produced, which can be used immediately. Objects which are to be made specially waterproof are painted by the Chinese twice, or at the most three times. Dr. Scherzer saw in Pekin a wooden box which had traveled the tedious road via Siberia to St. Petersburg and back, which was found to be perfectly sound and waterproof. Even baskets made of straw become, by the use of this cement, perfectly serviceable in the transportation of oil.

Pasteboard treated therewith receives the appearance and strength of wood. Most of the wooden public buildings of China are painted with schio-liao, which gives them an unpleasant reddish appearance, but adds to their durability. This cement was tried in the Austrian Department of Agriculture, and by the "Vienna Association of Industry," and in both cases the statements of Dr. Scherzer were found to be strictly accurate.

Faraday's Cap Cement.—Electrical Cement.—Resin, 5 oz.; beeswax, 1 oz.; red ocher or Venetian red in powder, 1 oz. Dry the earth thoroughly on a stove at a temperature above 212°. Melt the wax and resin together and stir in the powder by degrees. Stir until cold, lest the earthy matter settle to the bottom. Used for fastening brass work to glass tubes, flasks, etc.

Cement for Glass, Earthenware, etc.—Dilute white of egg with its bulk of water and beat up thoroughly. Mix to the consistence of thin paste with powdered quicklime. Must be used immediately.

Glass Cement.—Take pulverized glass, 10 parts; powdered fluorspar, 20 parts; soluble silicate of soda, 60 parts. Both glass and fluorspar must be in the finest possible condition, which is best done by shaking each in fine powder, with water, allowing the coarser particles to deposit, and then to pour off the remainder, which holds the finest particles in suspension. The mixture must be made very rapidly, by

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quick stirring, and when thoroughly mixed must be at once applied. This is said to yield an excellent cement.

Gutta Percha Cement.—This highly recommended cement is made by melting together, in an iron pan, two parts common pitch and one part gutta percha, stirring them well together until thoroughly incorporated, and then pouring the liquid into cold water. When cold it is black, solid, and elastic; but it softens with heat, and at 100° Fah. is a thin fluid. It may be used as a soft paste, or in the liquid state, and answers an excellent purpose in cementing metal, glass, porcelain, ivory, etc. It may be used instead of putty for glazing windows.

Iron Cement for Closing the Joints of Iron Pipes.—Take of coarsely powdered iron borings, 5 lb.; powdered sal-ammoniac, 2 oz.; sulphur, 1 oz.; and water sufficient to moisten it. This composition hardens rapidly; but if time can be allowed it sets more firmly without the sulphur. It must be used as soon as mixed and rammed tightly into the joint.

2. Take sal-ammoniac, 2 oz.; sublimed sulphur, 1 oz.; cast iron filings or fine turnings, 1 lb. Mix in a mortar and keep the powder dry. When it is to be used, mix it with twenty times its weight of clean iron turnings, or filings, and grind the whole in a mortar; then wet it with water until it becomes of convenient consistence, when it is to be applied to the joint. After a time it becomes as hard and strong as any part of the metal.

Kerosene Oil Lamps.—The cement commonly used for fastening the tops on kerosene lamps is plaster of Paris, which is porous and quickly penetrated by the kerosene. Another cement which has not this defect is made with three parts of resin, one of caustic soda, and five of water This composition is mixed with half its weight of plaster of Paris. It sets firmly in about three quarters of an hour. It is said to be of great adhesive power, not permeable to kerosene, a low conductor of heat, and but superficially attacked by hot water.

Cement for Uniting Leather and Metal.—Wash the metal with hot gelatine; steep the leather in an infusion of nut galls (hot) and bring the two together.

Cement for Leather Belting.—One who has tried everything says that after an experience of fifteen years he has found nothing to equal the following: Common glue and isinglass, equal parts, soaked for 10 hours in just enough water to cover them. Bring gradually to a boiling heat and add pure tannin until the whole becomes ropy or appears like the white of eggs. Buff off the surfaces to be joined, apply this cement warm, and clamp firmly.

Litharge and Glycerine Cement.—A cement made of very finely powdered oxide of lead (litharge) and concentrated glycerine unites wood to iron with remarkable efficiency. The composition is insoluble in most acids, is unaffected by the action of moderate heat, sets rapidly, and acquires an extraordinary hardness.

Cement for Attaching Metal to Glass.—Copal varnish, 15; drying oil, 5; turpentine, 3. Melt in a water bath and add 10 parts slaked lime.

Paris Cement for Mending Shells and other Specimens.—Gum arabic, 5; sugar candy, 2; white lead, enough to color.

Porcelain Cement.—Add plaster of Paris to a strong solution of alum till the mixture is of the consistency of cream. It sets readily, and is said to unite glass, metal, porcelain, etc., quite firmly. It is probably suited for cases in which large rather than small surfaces are to be united.

Soft Cement.—Melt yellow beeswax with its weight of turpentine, and color with finely powdered Venetian red. When cold it has the hardness of soap, but is easily softened and moulded with the fingers, and for sticking things together temporarily it is invaluable.

Soluble Glass Cements.—When finely pulverized chalk is stirred into a solution of soluble glass of 30° B. until the mixture is fine and plastic, a cement is obtained which will harden in between six and eight hours, possessing an extraordinary durability, and alike applicable for domestic and industrial purposes. If any of the following substances be employed besides chalk, differently colored cements of the same general character are obtained: 1. Finely pulverized or levigated stibnite (gray antimony, or black sulphide of antimony) will produce a dark cement, which, after long burnishing with an agate, will present a metallic appearance. 2. Pulverized cast iron, a gray cement. 3. Zinc dust (so-called zinc gray), an exceedingly hard gray cement, which, after burnishing, will exhibit the white and brilliant appearance of metallic zinc. This cement may be employed with advantage in mending ornaments and vessels of zinc, sticking alike well to metals, stone, and wood. 4. Carbonate of copper, a bright green cement. 5. Sesquioxide of chromium, a dark green cement. 6. Thénard's blue (cobalt blue), a blue cement. 7. Minium, an orange colored cement. 8. Vermilion, a splendid red cement. 9. Carbon red, a violet cement.

Sorel's Cement.—Mix commercial zinc white with half its bulk of fine sand, adding a solution of chloride of zinc of 1·26 specific gravity, and rub the whole thoroughly together in a mortar. The mixture must be applied at once, as it hardens very quickly.

Steam Boiler Cement.—Mix two parts of finely powdered litharge with one part of very fine sand, and one part of quicklime which has been allowed to slake spontaneously by exposure to the air. This mixture may be kept for any length of time without injuring. In using it a portion is mixed into paste with linseed oil, or, still better, boiled linseed oil. In this state it must be quickly applied, as it soon becomes hard.

Turner's Cement.—Melt 1 lb. of resin in a pan over the fire, and, when melted, add ¼ of a lb. of pitch. While these are boiling add brick dust until, by dropping a little on a cold stone, you think it hard enough. In winter it may be necessary to add a little tallow. By means of this cement a piece of wood may be fastened to the chuck, which will hold when cool; and when the work is finished it may be removed by a smart stroke with the tool. Any traces of the cement may be removed from the work by means of benzine.

Wollaston's White Cement for Large Objects.—Beeswax, 1 oz.; resin, 4 oz.; powdered plaster of Paris, 5 oz. Melt together. To use, warm the edges of the specimen and use the cement warm.

The Steam Fire Engine.

The following suggestions to engineers who have not had much experience in running engines are taken from the general orders of the New York Fire Department, and contain hints that should be useful in the care of all kinds of steam machinery:

1. In laying your fuel in the fire-box first lay plenty of shavings, then light dry kindling wood, filling your furnace full, which in most cases will give you steam enough by the time you arrive at a fire to commence work, provided you light your fire when you leave the house, which, as a general rule, is advisable.

2. If you use coal, be careful to keep a thin fire and not clog it. Use the coal in as large lumps as possible, and do not break it up unnecessarily in the furnace. The best coal for this purpose is clean cannel in lumps free from dirt and dust.

3. Be careful not to let so much fire collect under your engine as to burn the wheels. When working for a long time at fires there is some danger of doing so.

4. The Amoskeag boiler is an upright tubular boiler, with a submerged smoke-box and fire-box, surrounded with water. When the engine is running the water in the boiler should be carried so as to stand at the third gauge cock, which is placed near the top of the tubes, and it should never be carried below the center of the tubes, at which point the first gauge cock is located.

5. Avoid using an unnecessary amount of steam, the tendency is to use more than is required. From sixty to eighty pounds is as much as you will generally require to do good fire duty.

6. The engine has two suitable feed pumps for supplying the boiler with water. One of the pumps should be worked nearly all the time in order to keep water in the boiler at the proper height, and to preserve an even pressure of steam.

7. If brackish water is used for supplying the boiler, or if the boiler becomes foul from long use without being blown off, it is likely to foam or prime. If foaming occurs while the engine is working at a fire it may be prevented or diminished by opening the surface blow-off cock. After the engine is returned to the house, the water should be blown entirely out of the boiler through the blow-off cock near the bottom of the boiler with a steam pressure of about twenty pounds, and the boiler refilled with fresh water. This process may be repeated until the boiler becomes clean.

8. The pump upon the Amoskeag engine is a vertical double acting pump, with the cylinder surrounded by a circular chamber, divided vertically outside the cylinder so as to answer both for the suction and discharge chambers of the pump; it has a separate valve plate at the top and bottom of the pump carrying both the suction and discharge valves, the suction valve upon one side of the plate and the discharge valve upon the other. Each of those valve plates can be reached by taking off the top and bottom of the pump, which is so constructed as to be readily removed. The discharge and suction parts of the water chamber surrounding the cylinder are connected by a valve in the vertical partition which is called a relief valve.

9. With a single long line of hose it may be necessary to open your relief valve a little, but at all other times be particular to have it closed, except when you want to feed your boiler without forcing any water through the hose.

10. In the smokepipe, directly over the upper flue sheet, a valve is placed which is called the variable exhaust valve. By operating this valve the size of the aperture for the escape of the steam from the steam cylinder is increased or diminished, thus regulating the draught of the chimney and the heat of the fire. This valve should be closed when the engine is started until a fair working pressure of steam is obtained, after which it may be opened.

11. Care should be taken to have the suction hose and its connections air tight.

12. Open your discharge gate and cylinder drain cock before starting your engine.

13. Don't let the flues of your engine get filled up.

14. Be particular to take your engine off the springs before you work it and to place it on the springs again when done working.

15. With a long line of hose on be particular to open your throttle gradually. If you open it too suddenly you are liable to burst your hose.

16. The pumps of the engine should be examined at least once in six months to see that the valves and all parts are in good condition. The pump valves should have a lift of about three-eighths of an inch and the suction valves the same lift.

17. The inside of the steam cylinders and the steam valves should be oiled or tallowed always after the engine has been worked at a fire, and as often as it may be necessary to keep them well lubricated, and all the parts of the engine where liable to friction should be kept well oiled. Be particular to use an abundance of oil on the link block, where there is more friction than in any other part.

18. The running gear and every part of the engine liable to disarrangement or accident should be thoroughly examined every time after the engine has been out of the house, whether it has been worked at a fire or not.

19. Whenever your engine is repaired try to help to do it yourself, as by so doing you get familiarity with it that you can in no other way obtain. If the feed was turned on and the feed pumps were at work, but if the water did not run into the boiler, what would be done in such a case? To examine the hydrant and see if it was turned on or off; examine the check valve to see that it was in operation; this can be done by applying the ear to the chamber and ascertaining if the valve rises and falls at each stroke of the pumps, and also apply the hand to the pipe below the check valve in order to ascertain if it is cool; if they are all right, examine the blow-off cock and all other connections with the boiler to ascertain if they were closed; and if they are closed, the pumps must be pumping air into the boiler instead of water; also examine the pumps and induction pipes, in order to ascertain if they were not leaking, and if so stop the leak. If the check valve should not be in operation, examine the pumps, also the pump valves, and see if they were not bursted, either of which causes prevent the pumps from delivering water to the boiler.

There are four causes for feed pumps becoming hot, namely: 1st. There may be so small a quantity of eyedetious water used to cause it. 2d. It may be carried from muddy water or tight packing. 3d. The check valve and relieving valve may be caught up or very breaky, allowing the hot water from the boiler to run back to the pumps. 4th. External application of heat, the pumps being situated near the boiler.

Steam is a thin elastic fluid generated by the application of heat to any fluid (water generally used); the power of steam is its expansion; superheated steam is any steam which has been heated in a separate state to a high degree of temperature under pressure; in this condition its mechanical and chemical power are wonderfully increased. Water will boil at 212° Fah.

The following are the supplies which every engine in the department is furnished with: 20 feet of suction hose, a suitable brass strainer for suction hose, a brass hydrant connection for suction hose, a brass signal whistle, two plated gauges, one to indicate the pressure of steam upon the boiler and the other the pressure of water at the pumps or leading hose; two discharge pipes for leading hose, with a complete set of changeable nozzles, from ⅞ inch diameter to 1¼ inches diameter inclusive; two brass-bound fireman's hand lanterns, a large brass oil can, a jackscrew for convenience in oiling the axles, a coal shovel, and fire poker. A small tool-box furnished with such small tools as may be required about the engine when in use, such as hammers, wrenches, and the like.

Dimensions of a second-class double plunge engine, crane neck frame: Height from floor to top of smokestack, 8 feet 8 inches; length over all, including tongue, 23 feet 2 inches; diameter of boiler, 2 feet 7 inches; diameter of pumps, 4¼ inches; stroke of pumps, 8 inches; diameter of steam cylinders, 6⅞ inches; number of discharge gates, 2; capacity in gallons per minute, 700; weight, about 5,400 pounds. Second-class double pump crane neck engine: Diameter of grate surface, 32 inches; size of door, 8 by 12 inches; number of tubes, 258; diameter of tubes (internal), 1⅛ inches; bottom of boiler to bottom of fusion pipe, 20 inches; bottom of fusion pipe to 1st gauge cock, 12 inches; distance between gauge cocks, 5 inches; number of gallons to 3d gauge cock, 40 cubic feet; steam room, 3 feet.

American Losses by Fire.

The amount of losses in the United States by fire during 1879, as reported to insurance companies, was $77,703,700; add to this the uninsured losses that are not reported, and it will fall but little short of the $100,000,000 claimed as the annual loss in this country. Canada is not included in these reports.

In the four years, 1875–6–7 and 8, there were burned wholly or in part, in the United States: 1,354 hotels, 263 churches, 182 school houses, 40 court houses, 42 alms houses, hospitals, and asylums—1,883 in all. It would naturally be supposed that buildings of the character named would be built with more than ordinary care, but the record does not show such to be the case. Indeed, the more pretentious the building, the more careless seem to be the owners.

AGRICULTURAL INVENTIONS.

Mr. Joseph Custer, of Goshen, Ohio, has patented a seed planter, so constructed that it may be used for planting potatoes and small seeds, as required.

Mr. Nathan L. Brass, of Juniata, Neb., has patented an improved sulky-harrow, which is simple and convenient in use, being easily raised from the ground and adjusted to work at any desired depth in the soil.

A combined scraper and fork, patented by Mr. George P. Ruhle, of Swengel, Pa., is intended for use as a scraper, hay lifter or fork, and dung fork; and the invention consists in a novel combination and arrangement of parts, whereby the apparatus may be conveniently used for the purposes named.

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NEW COTTON PICKING SHADE.

The annexed engraving scarcely requires description, as the purpose and advantages of the invention will be readily seen. Cotton picking, at best a laborious occupation, becomes irksome when conducted under a burning tropical sun; and a device which will afford to cotton pickers an efficient protection from the influence of strong sunlight and heat should receive attention. Such a device is shown in the accompanying engraving, and it must prove beneficial to both laborers and employers, for without a doubt more work can and will be done when a protection of this kind is afforded. The invention consists simply of a protective shade of cotton cloth, mounted on a light frame provided with wheels, which facilitate its movement along the rows of cotton to be picked.

This invention was recently patented by Mr. J. C. Benthall, of Schulenburg, Texas.

BENTHALL'S COTTON PICKING SHADE.

A Silver Fossil.

The *Bulletin* of the Geological Society of France describes an ammonite of silver, found in a silver mine at Caracoles, South America, by M. Fremier, who was for some time director of the mines at that place. This remarkable specimen was found with a number of other ammonites belonging to the two species *A. peramatus* and *A. plicatilis*, which had not been mineralized with silver salts. The ammonite in question, however, had been entirely replaced by chloride of silver, which had been partially reduced to the metallic condition. Light is thrown by this specimen upon the origin of the native silver which occurs in the Caracoles mines; for it is only fair to infer that this metal has, in like manner, been reduced from the state of chloride.

PUMPING SYSTEM FOR HYDRAULIC PRESSES.

There are two objections to the use of hydraulic presses as ordinarily arranged. One is, that the press works at a uniform rate of speed throughout the entire distance traveled by the platen, and therefore of necessity works slowly; the other is, that the press must be near the source of power to work to the best advantage.

The accompanying engraving represents an improved system in which these objections are not found, and which renders the hydraulic press applicable in many places where without these improvements it could not be used. It also increases the capacity by giving a greater supply of water under pressure during the early part of the operation of pressing.

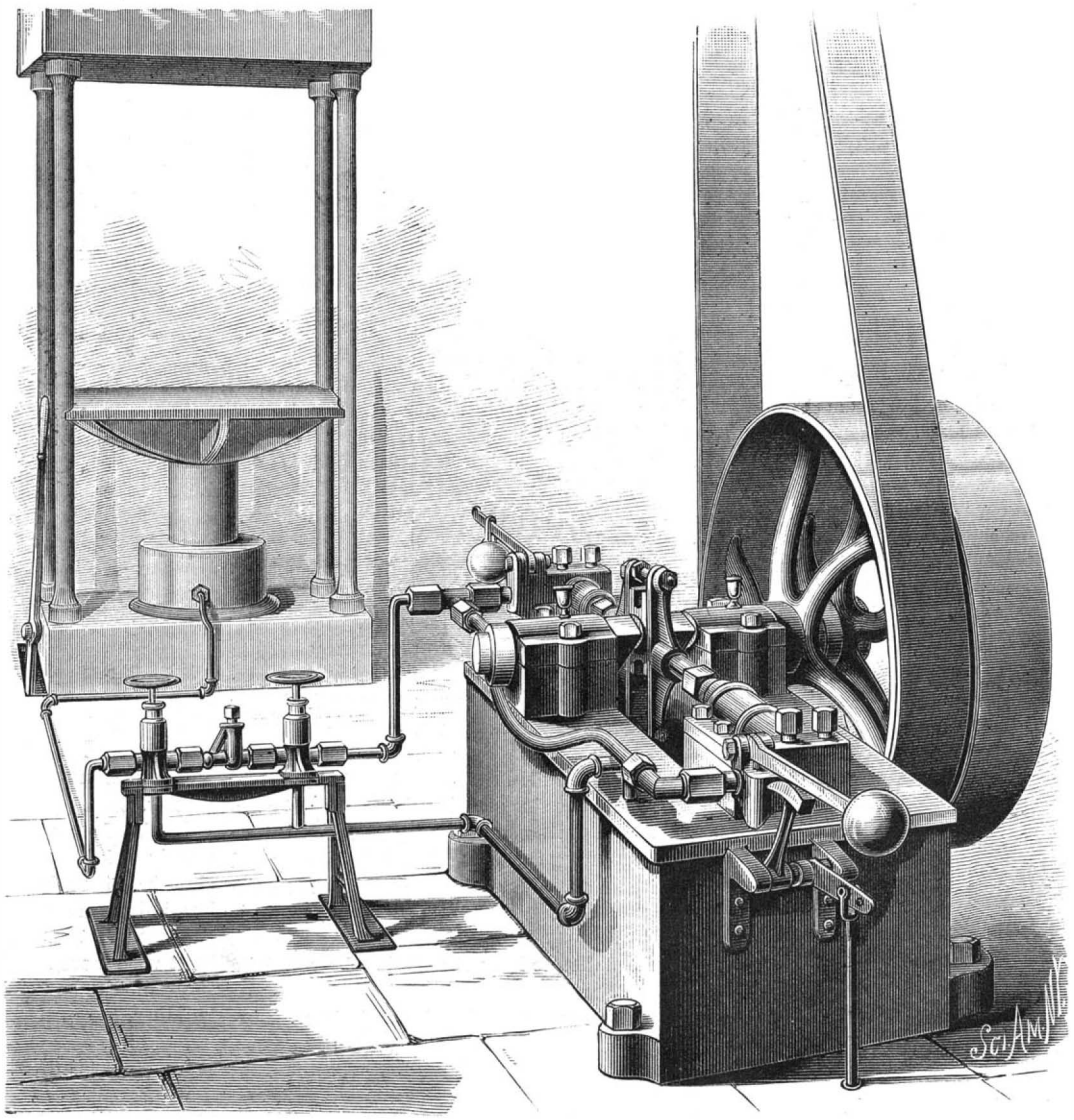
The pump shown in the engraving has two pistons, one of which is larger than the other, and designed to be applied at the beginning of the operation of pressing, to supplement the smaller one, and to accelerate the plunger of the press by forcing large quantities of water into the press cylinder. When the prescribed limit of pressure for the larger pump is reached, the pump is thrown off by means of the lever seen at the side of the press in the background. This lever is connected by bell cranks and shafts with the cam seen under the relief valve lever of the larger pump; the heavy finishing pressure is given by the smaller pump.

The valves to these pumps are of large area, and are so arranged that they may be readily taken from their seats to remove any foreign substance, or for the purpose of refitting, should it become necessary. All of the parts subjected to wear are capable of being easily "taken up," and the machine is constructed on the interchangeable plan. By employing a set of valves shown in the middle of the engraving, the pump may be placed in any convenient position, no matter how far distant from the press. The press will then be controlled by these valves, while the pump is allowed to run continuously.

Pumps are made on this plan with four or six plungers. By modifying the arrangement of the valves, several presses may be conveniently operated with a two-plunger pump.

We are informed that a large number of these pumps are in use on a great variety of work in all parts of the United States, giving good satisfaction. Many of them are in the hands of parties having little mechanical skill.

For further particulars address E. Lyon & Co., 470 Grand street, New York City.



IMPROVED PUMPING SYSTEM FOR HYDRAULIC PRESSES.

Rapid Photos.

At a recent meeting of the Edinburgh Photographic Society an interesting lecture was delivered by Mr. W. H. Davies on "Rapid Studies from Nature," during which he introduced a number of screen pictures from instantaneous photos, representing movements of life in various forms. Among the pictures thus shown were the Muybridge horse pictures, from California, heretofore shown in our paper. These photos represented the various positions of the horse's feet in the act of stepping, and were taken while the animal was going at a 2:40 gait. The lecturer, after complimenting the American photographer who took these remarkable pictures, added: "I may mention that the general speed of a fast trotting horse is about two and a half miles a minute!" Our cousins across the water are so unaccustomed to the sight of fast trotters that perhaps it is not surprising that the lecturer's statement should have been received as correct. Their ideas of the speed of American horses must have made a most rapid advance.

THE House Committee on Patents have decided to report adversely on the application for an extension of the patent on the Miller platform and coupler, on the ground that the patent has run long enough, and that the patentee has received sufficient remuneration already.

How to Get Rid of Rats in Mills and Granaries.

Millers are well aware of the terrible annoyance occasioned by rats in the mill and warehouse, and may find a useful hint in the following, from a note presented to a French industrial society, by M. Benner. The *American Miller* translates:

"Every one understands the ravages caused by rats in warehouses, storehouses, granaries, and the like. The amount of damage inflicted by these guests is appreciated by those engaged in pursuits the establishments of which suffer periodical invasions by the rodents. Their annual depredations cost millions of money. To destroy these animals, traps of all kinds have been employed and poisons of every description of undoubted deadly power. But the instinct of self-preservation in these unwelcome guests renders them inefficacious, and often injures domestic animals. Lately, one of my friends related to me the following, which took place in a large mill operated by his father. There the rats live, in a happy quiet, for the reason that the proprietor of the establishment has discovered by experience that each time he attempted to destroy them by traps or poisons, no longer contenting themselves with a diet of grain and flour, they became aggressive, and appeared to take vengeance by gnawing into the bolts and sacks in the course of a single night.

"'Like every industry which uses a water course, mine had suffered particularly from the periodical invasion of rats, which, at the approach of the rigorous season, took up their winter quarters in the warmest parts of the establishment. At this time they quit their burrows on the banks of the stream and invade the premises, gradually working up from the basement to the loft. For years I tried every means to accomplish their destruction, but to no purpose. One day when the work of repairing a wall of masonry, which supported the engine, called me below, I saw that the limestone upon which the platform of the cylinder rested had been gnawed down to the cement. This warm and dark passage had served as a retreat for the rats who raided the establishment. The idea struck me to suffocate them in their den. I took some moist chloride of lime, which I passed into each opening, and when all the rat holes were covered with paste, I sprinkled over it a small quantity of oxalic acid. The mason immediately filled up all the openings, but not before some of the rats, disturbed by the freeing of the chlorine gas, had escaped.

"'During the winter which followed, I was able to see that the rats were a little less numerous in that part of the establishment. Encouraged by this partial success, I carefully sought out the rat holes on the ground floor and went through a similar operation, with the difference that I used liquid chloride, which I poured into the rat holes until the liquid flowed back to the opening. Then I poured in hydrochloric acid diluted with water, after the earth or masonry had absorbed the greater part of the first liquid. By this mixture a violent escape of chlorine gas is produced, and the rats were invariably asphyxiated. When the operation was completed, the holes were filled up to prevent the coming of other inhabitants. That year I noticed that the rats had disappeared from the ground floor, but I could still hear them in the ceiling of the other stories. I sought all the openings by which the rats penetrated between the ceiling and the floor, and prepared pieces of sheet iron of a size sufficient to cover each hole completely. Then I placed several handfuls of cotton at the bottom of the opening in such a way as to cover the greater part of it, and dipped a piece in the moist chloride of lime and dropped it upon the first layer destined to absorb the liquid part. Then I sprinkled on some powdered oxalic acid, and alternately introduced the chloride and the acid until the entrance was filled, and then I nailed on the piece of sheet iron. This operation was gone through with in each story, and the result was complete; all the rats perished from the fumes of chlorine.

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That was fifteen years ago, but whenever I discover a rat hole in the establishment I administer prompt justice with chlorine and acid.'"

Spectroscopic Notes.

Prof. H. Vogel recommends the use of a small hydrogen flame for spectroscopic work in places where there is no illuminating gas, as in the country and in some private houses. It is much hotter than alcohol, and, in fact, not inferior to the Bunsen gas burner in heat. Any form of constant generator can be employed, as the impurities in ordinary zinc and acid do not affect the spectrum. The gas is burned from a blow pipe jet, as a glass jet would yield faint spectra of the alkalies.

The same distinguished spectroscopist has also published a simple method for the detection of cobalt in the presence of nickel and iron. The three metals are converted into sulphocyanides by means of potassic sulphocyanide. Carbonate of soda is now added to the intensely red solution until the iron is all thrown down. The solution is then filtered and shaken with ether and amylic alcohol, in which the sulphocyanide of cobalt dissolves with a blue color. When nickel as well as cobalt are present the ethereal solution is greenish, but the cobalt is detected by characteristic absorption bands between C and D. In a mixture of 400 parts of ferric chloride to 1 part of cobaltic chloride, the latter was distinctly visible, as also in the presence of 200 parts of nickel. This test for cobalt is so delicate as to indicate the presence of 0·0000258 gr. of metallic cobalt to the cubic centimeter of solution. Sulphocyanide of nickel solutions give no absorption bands, and the sulphocyanide of cobalt in aqueous solution only shows a broad dark place in the green.

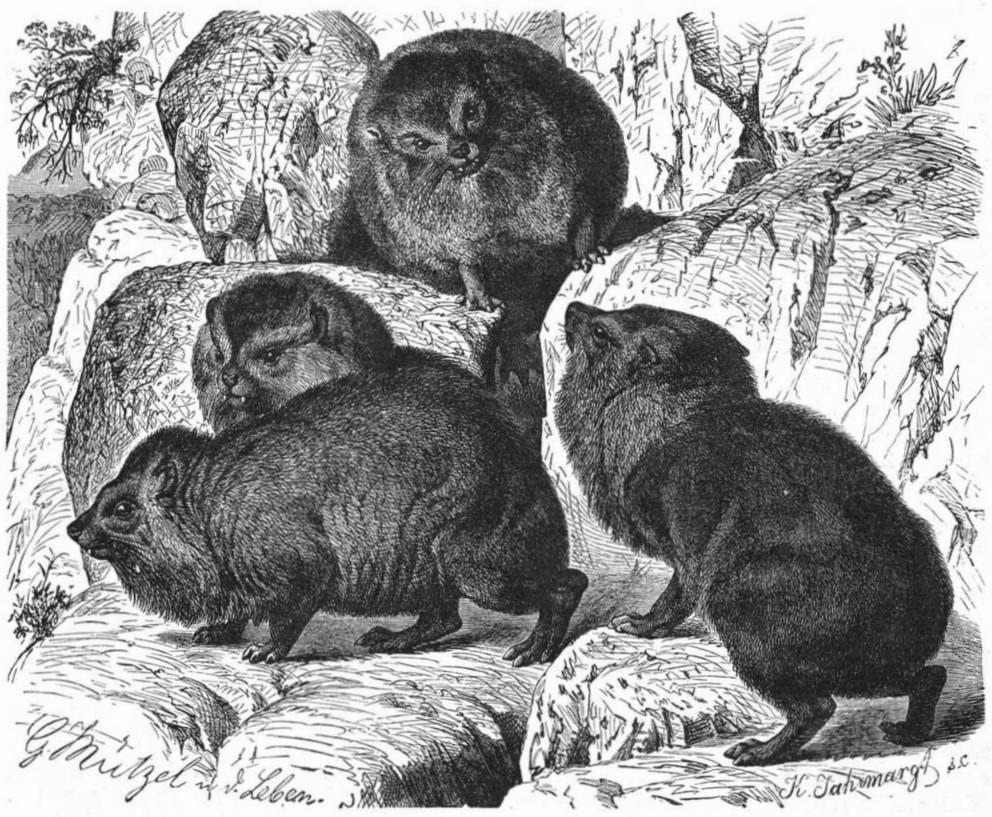
THE HYRAX.

One of the most curious little animals in existence is the hyrax, interesting not so much from its imposing external appearance, as for its importance in filling up a link in the chain of creation.

About as large as a tolerably sized rabbit, covered with thick, soft fur, inhabiting holes in the banks, possessing incisor-like teeth, and, in fine, being a very rabbit in habits, manners, and appearance, it was long classed among the rodents, and placed among the rabbits and hares. It has, however, been discovered in later years that this little rabbit-like animal is no rodent at all, but is one of the pachydermata, and that it forms a natural transition from the rhinoceros to the hippopotamus. On a close examination of the teeth, they are seen to be wonderfully like those of the hippopotamus, their edges being beveled off in a similar manner, and therefore bearing some resemblance to the chisel-edged incisors of the rodents. There are several species of hyrax, one of which inhabits Northern Africa and Syria, while the other two are found in Abyssinia and South Africa.

The South African hyrax is termed by the colonists klip das, or rock rabbit, and is found in considerable plenty among the mountainous districts of its native land, being especially common on the sides of the Table Mountain. It is largely eaten by the natives, who succeed in killing it in spite of its extreme wariness and activity. Among the crevices and fissures in the rock the hyrax takes up its abode, and may often be seen sitting in the warm rays of the sun, or feeding with apparent carelessness on the aromatic herbage of the mountain side. It is, however, perfectly secure, in spite of its apparent negligence, for a sentinel is always on guard, ready to warn his companions by a peculiar shrill cry of the approach of danger. Sometimes the hyrax is seen at a considerable height, but is often observed near the sea shore, seated on rocks which are barely above high-water mark.

Besides mankind, the hyrax has many foes, such as the birds of prey and carnivorous quadrupeds, and is destroyed in considerable numbers. The fore feet of this animal are apparently furnished with claws like those of the rabbit, but on a closer inspection, the supposed claws are seen to be veritable hoofs, black in color, and very similar to those of the rhinoceros in form. The hyrax is an agile little creature, and can climb a ragged tree trunk with great ease. It is rather hot in its temper, and if irritated becomes highly excited, and moves its teeth and feet with remarkable activity and force.



HYRAX.—(*Hyrax abyssinicus.*)

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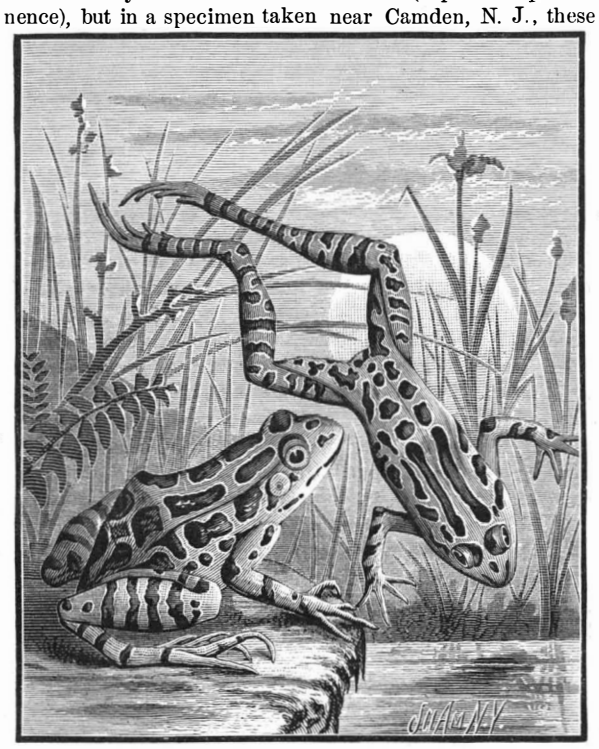
THE PICKEREL FROG.

BY C. FEW SEISS.

The pickerel frog (*Rana palustris*, Le Conte) is the prettiest and most strongly marked of the *ranidæ* found in this section of the country. Its ground color above is pale yellowish brown, with four rows of more or less regular, squarish dark brown spots from the head to the vent. There are commonly three or four spots in each dorsal row, from behind the eye to the bend of the back (supra-iliac prominence), but in a specimen taken near Camden, N. J., these



THE PICKEREL FROG.—(*Rana Palustris.*)

spots are confluent, thus forming two blackish bands (see left-hand figure). This is the only specimen I ever saw thus marked, although I have frequently observed two spots to be confluent. The spots are always margined with dull grayish white. There are two glandular dorsal folds, one on each side of a yellowish or bronze color, but they are not so well defined as in the crying frog (*Rana clamitans*) or shad frog (*R. halecina*). The body beneath is yellowish-white; posterior part of thighs granulated and of a bright yellow color in life. The legs and feet are barred and spotted with dark brown. Dr. Gunther, in his "Catalogue of the Batrachia Salientia," gives as specific characters: "Body with *two* glandular folds on each side. Above *greenish*, with a row of squarish darker spots between the glandular folds." I have found generally but one fold, and where two do exist the upper cannot properly be designated as such. It also commonly runs through the row of spots, and not above it. I have never seen a "greenish" pickerel frog, either alive or in alcohol.

The pickerel frog is for the most part solitary in its habits, except during the breeding season. Although it is called *palustris* (marshy), it is found in springs and brooks more frequently than in low and extensive marshes. With the exception of the wood frog (*Rana temporaria sylvatica*), this is the most slender and active species we have. It will spring upward several feet to seize an insect on the wing.

I have noticed a peculiar way it has of showing its displeasure. Thus when I dropped an insect in the vivarium near two of these frogs, and the most active or lucky seized and swallowed it, the disappointed frog wheeled around and struck the object of his displeasure in the face and eyes with his tongue. And it is evident from the way the assaulted frog closed his eyes and moved away, that he did not relish such treatment.

We had a male of this species in our vivarium two winters ago, who would persist in creeping down and completely hiding himself under the moss at the approach of every cold spell during the winter.

The length of an adult pickerel frog, from nose to vent, is about 3 inches. It is found in the eastern United States from Maine to Virginia.

Distribution of Plants.

BY REV. L. J. TEMPLIN, HUTCHINSON, KANSAS.

The world is full of wonders to every one who has not made up his mind to be astonished at nothing he may see. To the thoughtful mind there is much in nature to inspire wonder and admiration. The wise adaptation of means to ends, and the beautiful harmony that exists throughout all the realm of organic nature, lead the mind, free from bias, to the inference that some wise, intelligent power orders and governs all these relations and harmonies. Perhaps nowhere in nature is there a more manifest exhibition of wisdom in the adaptation of means to the accomplishment of a worthy purpose, than is seen in the various methods employed in nature for the dissemination of plants by the distribution of seeds.

In looking at this subject with an intelligent eye, the mind cannot shut out the conviction that some intelligent designer must have been employed in planning this scheme that has so much of both excellence and variety to recommend it to the judgment. To say that all this is to be attributed to chance, is to endow chance with all the attributes of a Deity, which is the very reverse of the idea intended to be conveyed by the term. In the sense intended it is perfectly absurd to attribute this or any other work to chance, for in that sense chance is nothing, and consequently can do nothing. So we regard it as the result of evolution; but I cannot see that this relieves the difficulty, even if the truth of the theory of evolution be admitted. Evolution is simply the working out of certain results under the operation of law. But what is this law? It is not correct to say that it is force, though I think many make this mistake. Law is only the established order or manner in which force operates; so that if we admit the intervention of law and a thousand or ten thousand secondary causes, still this law must have originated with a lawgiver, and behind all these secondary causes the mind must rest at last on the first cause, the author of all other causes. But I did not start out to write a moral or philosophical essay, but to call attention to some of nature's method of distributing the vegetable kingdom over the world. In producing these results we find three classes of agents at work: the waters, the winds, and animals, besides certain arrangements within the plants themselves for the accomplishment of this purpose. And we find the seeds themselves adapted to these different means of transportation. The light character of many seeds well adapts them to floating from place to place, while their impervious coverings protect them while being carried long distances by the currents of the ocean or of rivers, and then when they lodge on some island or other shore they readily spring up and grow. What, for instance, can be better adapted to floating from island to island than the tough, corky covering of the cocoanut? The seeds of grasses and other plants are washed down from the higher grounds by streams, and they are thus widely distributed.

The seeds of many plants, as of the dandelion, thistle, and a long list of similar plants, are furnished with a tuft of downy or silky pappus, that will enable them, when ripe, to float away on the breeze and thus be scattered far and wide. The seeds of some species of poplar, as cottonwood, are attached to a bunch of fine cotton that serves as a buoy to bear them up through the air, by means of which they are frequently carried many miles from the parent tree. Seeds are often disseminated through animal agency. Animals frequently carry seeds and nuts away and bury them for winter food, where they are forgotten and left to grow.

Many seeds of fruits are swallowed by birds and carried to distant places and voided uninjured, and there spring up and grow. Thus the seeds of cherries, grapes, gooseberries, blackberries, and many others of like nature, are sown broadcast over a large extent of country. During an invasion of the Rocky Mountain locusts into Iowa a few years ago, they left the ground where they fed thickly strewn with the seeds of some species of grass, new to that locality,

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which they had brought from the far Northwest. Many seeds are provided with hooked barbs, by which they cling to clothing and the coats of animals, and are carried about from place to place.

Many people are familiar with the cockle burr, the Spanish needle, the "beggar lice," and burdock, and how tenaciously they adhere to any surface where they can get a hold. To this we may add the sand burr (*Cenchrus tribuloides*), with its sharp spines, one of the most execrable weeds I have made the acquaintance of. Some seeds, as of the maple, ash, elm, etc., are furnished with a wing that causes them to sail off some distance in falling. The locust, Judas tree, or redbud, and others, have a light pad that will often sail off to a considerable distance, thus scattering their seeds.

Some kinds of bean have the pod so arranged that when it bursts it suddenly twists into a coil, throwing the seeds a considerable distance. This habit in the *Impatiens*, or touch-me-not, geranium, etc., is well known. The squirting cucumber (*Momordica elaterium*), when ripe, bursts with a considerable report, throwing its seeds many feet.

A few plants, when their seeds are ripe, travel over the country and sow them themselves. A good example of this kind is the "tumble weed," about the true name of which the doctors disagree. Two species grow here; the larger, which is the tumble weed here, grows in a thick cluster of very slender branches, and these so numerous that the bunch, which is often as big as a hogshead, can scarcely be seen through. When ripe they are torn from the roots by the wind, and then they roll and tumble, often with the speed of a racehorse, till they meet an obstruction that they cannot surmount, and there they rest till the wind changes, and then they start again; and this is kept up till they are worn out and broken to pieces. Their seeds are thus scattered over all the country.

A plant that grows on the deserts of Africa, the rose of Jericho (*Anastatica heirochuntica*), when ripe, curls into a ball, becomes detached from the soil, and rolls about before the wind till a light shower of rain falls, when it opens its seed pods and drops its seeds, which germinate in about eighteen hours. The wisdom of the arrangement here is seen when we remember that if it remained where it grew the whole plant would probably be covered by the drifting sands, and that if its seeds did not germinate quickly, while the transient moisture lasted, they never could grow at all. Thus does nature care for her children.—*Gardener's Monthly.*

Cinchona Culture for the Pacific Coast.

Mr. Willis Weaver, of Bogota, South America, has written a long letter to the Department of Agriculture advocating the introduction of the cinchona tree in California.

After reviewing the conditions under which the cinchona tree thrives naturally in South America, and, under cultivation, in India, Mr. Weaver says: "The cinchona seems to seek a dry soil, but a climate affording plenty of rain in certain parts of the year. The coasts of Northern California and Oregon would fulfill the conditions as to moisture; the slopes of the mountains would probably furnish hilly ground very similar to that occupied by the tree in its native habitat; while I believe that the temperature would admit of its cultivation even north of the mouth of the Columbia. It is also uncertain as to how far any undue dryness of the atmosphere may be overcome by irrigation. The surprising results already attained in the cultivation of the trees prepare us to expect further advances, and this may be one of them as naturally as anything else.

It is well known that the barks produced under cultivation are much superior to the natural bark, as the process of mossing the tree causes a remarkable development of the alkaloids in which their virtue consists. Also that the cultivated trees are not destroyed. A strip is taken off reaching the length of the trunk and one-third its circumference. The wound is then dressed with straw matting and kept wet until the bark forms anew. The next year another strip is taken, and so on, indefinitely. I am told that the harvest begins when the tree is five years old, but am not in a position to verify the statement.

"I have calculated roughly, according to the prices of land and labor here, that a plantation of a hundred acres might be put in at less than $1,000 an acre, covering all outlay—or say $1,500 to cover interest and all contingencies."

A yield of $8,000 an acre has been reported from Indian plantations. Mr. Weaver is convinced that with a wise choice of sites and judicious treatment, together with a careful selection of the proper varieties, the cinchona tree could be cultivated in many parts of the Pacific coast, and probably in New Mexico; that if irrigation can be made to supply the place of a naturally moist climate, the cultivation can be carried into a large part of the Colorado Valley and Texas, as well as into Northern Georgia and Alabama, and thence north along the southern slope of the Blue Ridge. He would not be surprised if the hardier varieties were found to grow even in Virginia and Colorado and in Arkansas, in favored situations on the southern slopes of the Ozark mountains.

Non-Inflammable Wood.

At a meeting of the British Association recently held at Sheffield, Col. P. P. De la Sala exhibited non-inflammable wood for building purposes, also wood shavings, non-inflammable, for the manufacture of mats, rope, etc. The inventor thus explains his peculiar method, which is already patented:

"Though all alkaline compounds reveal the property of rendering vegetable matter more or less pliable and non-inflammable, I preferably make use of carbonates of fixed alkalies in the following way: I dissolve in cold or warm clear water carbonates of potash or soda, or I make use of them in a solution of filtered water heated to the boiling point, and add hydrate of lime to this solution, graduating the strength so as not to exceed a specific gravity of 1·060 if potash is used, or 1·050 when soda is used. In the first case, the strength of the solution corresponds to about 30 grains of hydrate of potash to the fluid ounce, or about 20 grains of hydrate of soda to the fluid ounce. Wood to be used in naval construction, and in buildings or structures of wood on land, as well as vessels and land buildings already constructed, can be rendered fireproof by saturating the floors and decks, and all exposed woodwork, with alkaline lyes, and when dry, the wood may be whitewashed, painted, or varnished in the usual way.

"For boards, planks, or thicker pieces of timber, I graduate the time of immersion so as to form a coating of from one-sixteenth to one-eighth of an inch, which can be obtained in from four to twelve hours, according to the more or less porous nature of the wood, or the compactness of its fiber. I consider a coating of about one-eighth inch deep to be a sufficient fire protection for all kinds of timber for building purposes, as the spread of fire and great conflagrations generally originate in relatively small causes, such as burning cinders, dropped sparks from fireplaces, matches accidentally ignited, inflamed liquids, candles left burning, etc.; but the fireproof coating can be made deeper, or even to go through the whole timber, in the event of its being considered desirable to combine great flexibility with absolute non-inflammability. In this case I make use of hydraulic or other pressure, so as to force the alkaline lyes through the wood to the extent desired."

A comparison is yet to be made between this method and others as to relative cost of the flame prevention. *Per se*, any method of treatment whose cost exceeds that of fire destruction in a given case, is practically inapplicable.

The American Missionaries in Turkey.

A special correspondent of the London *Times*, in a recent letter to that journal from Turkey, dated at Aintab, Dec. 25, 1879, pays the following high tribute to the value and influence of American missionaries in that empire:

In a former letter I promised to give some account of the work of the American missionaries in Asia Minor, and I the more readily hasten to fulfill that promise, as the work of those missionaries is not without interest and importance in respect to the political future of the country. Not that the missionaries have interfered or are likely to interfere directly in political affairs, but it seems more and more evident from year to year that the institutions established by the missionaries are having a positive effect in making men acquainted with their natural rights, and also in showing to the native populations of the country that self-reliance and self-exertion are the only roads to happiness and prosperity. The statistics of the various missions in Asia Minor for the past year have been furnished me in advance of publication. As I turn them over I confess to a feeling of considerable embarrassment at attempting to compress the statistics, with needed explanations, into a single letter. If this is found impossible, I shall crave your indulgence for supplementary statements in a subsequent letter.

The first American missionary arrived at Constantinople in 1831; as the operations of the Americans have continued from that date to the present time without interruption, they extend over a period of 49 years. Much time was spent at first in exploring the country, mastering the languages of the people, becoming acquainted with their manners and customs, and in attempts, often unsuccessful, to overcome the prejudices and fanaticisms of those who looked with suspicion on the arrival of these strangers from a distant land.

As soon as possible after their arrival the missionaries began to work through the press, and they have gone on steadily through this department until the business of translating, publishing, and circulating their books and newspapers has reached large proportions—large at least for a semi-civilized country like Turkey. As no one language is used by all the races of Asiatic and European Turkey, it has been necessary to prepare books in several different languages—thus, for example, the Bible has been translated into the Arabic, Armenian, Turkish, Bulgarian, and Hebrew-Spanish languages, while editions have also been issued in Armeno-Turkish and Greco-Turkish, and portions of the Bible also in Kurdish. As might be expected, a large proportion of the books published by the missionaries are on religious and moral topics; yet there are many works on other subjects; in the list before me I find arithmetics, geographies, grammars, histories, works on mental philosophy, on teaching, algebras, geometries, a compendium of physiology, and other works of a similar kind. The history of the Reformation in the sixteenth century is given in several compact volumes. One solid octavo of several hundred pages is devoted to church history. From the report of the publication department for the past year I find that the missionaries have issued in the Armenian language during that year 19,175 copies of different works, amounting to 2,122,500 pages; in the Armeno-Turkish language, 23,300 copies, amounting to 1,524,200 pages; in the Greco-Turkish, 3,810 copies, consisting of 287,760 pages; and in the Bulgarian language, 14,915 copies, in 2,462,620 pages; or a total in the past years of 61,200 copies, in 6,397,000 pages. The same report states that the entire number of copies issued from the mission presses from the beginning amounts to 2,248,354, and the whole number of pages issued in the native languages of Asiatic and European Turkey amounts to 335,503,988. The expenditure in the publication department during the past year amounted to 388,510 piastres (T£=100), or about £3,500 sterling. Among the most useful and popular of the publications of the missionaries are several newspapers, partly religious and partly secular; these are published in the Bulgarian, Armenian, Armeno-Turkish, and Greco-Turkish languages. As the editors of these papers, during a long series of years, have taken much pains to furnish only the most reliable information to their readers, the papers have an established character for accuracy, which is not enjoyed by great numbers of sensational publications in the Levant. In this brief summary of what the Americans are doing in Turkey through the press, I have omitted entirely the operations of the missionaries in Syria and Egypt. As is well known, those operations are on an extended scale, but they are rather outside of the region to which this letter relates.

The missionaries attach great importance to the organization of native congregations and churches. These congregations are presided over by native preachers and pastors. The churches manage their own affairs, and support their pastors so far as possible, and, to a large extent, their own common and high schools. The missionaries, in dealing with the native congregations, act uniformly on the principle of helping only those who help themselves. The result has been that throughout the country are found many communities of intelligent men who are making continued and earnest efforts to sustain the institutions that have been founded by the missionaries. In many cases these communities are what are called self-supporting—that is, they draw nothing from foreign sources toward the expenses of their own schools, churches, and congregations. In all cases a large percentage of the expenses incurred are borne by the people, the proportion depending upon the size and ability of each congregation. Some idea of the number and importance of these congregations may be obtained from the following statistics. These statistics relate only to three missions in Asia Minor, and which are known as the Western, Eastern, and Central Turkey Missions. They do not include the reports from European Turkey and from Syria and Egypt:

The whole number of registered Protestants in Asia Minor is 24,975. These are formed into a separate civil community, having a chief or headman at Constantinople. The number of separate congregations of Protestants is 225; these are found in all the large cities and in many of the towns and villages that are scattered through the country, from the Black Sea to the Mediterranean, and from Constantinople to the borders of Persia. The total number of educated native pastors and preachers is 116, while the whole number of school teachers is 312. Quite a number of the native preachers, as well as some of the teachers in the high schools and colleges, are men of marked ability. The number of common schools is 283, and the whole number of scholars in these schools is 9,621. The branches taught in the common schools are reading, writing, spelling, arithmetic, geography, grammar, and sometimes algebra, physiology, and English. Great attention is given to the organization and management of Sabbath schools. The object of such schools is the simple study of the Christian Scriptures. The number of such schools is reported at 176, with an average attendance of 15,423 persons. Men, women, and children attend the Sabbath schools, and engage for an hour and a half each Sabbath in the earnest study of the Bible, aided by competent teachers, and under the general direction of the native pastors. That the native people are really in earnest in this work appears from the contributions which they make for its support. Very few men of wealth have joined the Protestants, while the great majority of the members of that community are men from the humbler classes of society—men who, under the accumulated burdens imposed upon them by the Turkish Government, find it very difficult to support themselvs and their families. Yet these laboring men gave during the past year, for the support of their own churches, schools, and other objects, 468,247 pias. (T£=100), or £4,214 sterling. The missionaries feel, doubtless with good reason, that this is one of the most encouraging items in their annual budget, not that the amount, in itself considered, is large, but because it is the best possible evidence of the sincerity and zeal of those who have joined the Protestant communities. One of the most encouraging results of the work of the missionaries in Asiatic Turkey is seen in the demand for schools, seminaries, and colleges of a high grade; this demand is not confined to either sex, nor to any particular people. To meet this demand boarding schools for girls, and high schools, colleges, and theological seminaries for young men, have been established at many important centers in Asia Minor. These institutions are all under the immediate control of the missionaries themselves, assisted in every case by competent native professors and teachers.

A detailed account of these educational institutions would lead me too far from the purpose of this letter, yet I may mention, as examples of what the Americans are doing in this respect, the girls' boarding schools at Marsovan, Brusa, Bitlis, Mardin, Kharpoot, and Aintab, the theological seminaries at Marash, Kharpoot, and Mardin, and the two colleges recently established at Aintab and Kharpoot. As these institutions are at central points, and as they are already exerting very considerable influence in the country, those who wish to obtain more complete information in regard to the

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missionary work in Asiatic Turkey would do well to put themselves in communication with the missionaries in charge of them. Robert College at Constantinople, and the Syrian Protestant College at Beyrout, are too well known to the British public to require special notice at my hands. It gives me pleasure, however, to report in regard to both of those deservedly popular institutions that their prospects were never so full of hope as at the present time.

Still another Chemical Photometer.

There are several metals like uranium which are more or less sensitive to light when mixed with organic matter. The high degree to which silver possesses this character is well known. Dr. Eder, in Vienna, has studied the action of light on corrosive sublimate (mercuric chloride), and finds that it is easily reduced to calomel (mercurous chloride) in the sunlight. As the former substance is soluble in water and the latter is not, a white precipitate shows the change. It was found that the following proportions were the most sensitive: Dissolve 40 grammes of oxalate of ammonia in 1 liter of water (4 per cent) and 50 grammes corrosive sublimate (5 per cent) in 1 liter of water. Mix together 2 volumes of the former and 1 of the latter. In the red, yellow, and yellowish-green portions of the spectrum the solution remains clear, but is rapidly precipitated in the blue, violet, and ultra violet. The weight of the precipitate per minute is proportional to the photometric strength of the light.

The Largest of Land Animals.

In the *American Journal of Science and Arts*, Prof. Marsh describes the largest land animal yet known to have existed on the globe. Its name is *Atlantosaurus immanis*. The thigh bone of this creature is over 8 feet long, with a thickness at the larger end of 25 inches, though the bone has no true head. A comparison of this bone with the femur of a crocodile would indicate that the fossil saurian, if of similar proportions, had a total length of 115 feet. That the reptile was 100 feet long when alive is at least probable. The other bones of this animal that have been found are proportionately gigantic; caudal vertebra has a transverse diameter of more than 16 inches. All the bones of this reptile yet discovered are in the Yale College Museum. They are from the Upper Jurassic of Colorado.

A Fish Story.

A Boston correspondent of the *Forest and Stream* tells the following remarkable story. The scene is laid in Long Island, where, on the shore of a pond, the correspondent was watching the play of swallows as they skimmed just over the surface of the water shortly before sunset. "About a hundred yards out was a bed of lily pads; and as the swallows skipped it, occasionally a good sized ripple could be seen, and sometimes a break from the edges indicating a fish there. This fastened my attention to the particular place. I had often seen cats play with swallows, swooping at them, but the idea of fish doing the same was something new to me. Presently I saw a clean breach, and a fine large pickerel showed his whole size and got a swallow, too, as he disappeared beneath the water. This I saw repeated several times, and I called the attention of my companion to this novel sight. While we were watching we saw two large fish break at the same swallow, the fish coming from opposite directions, and each head on to each. Both missed the swallow, but, singular to relate, only one fish was seen to fall into the water, and neither was seen to pass the other. My companion and myself looked with wonder. There was a great commotion in the water with a continuous spattering, and a boat being handy we jumped in and rowed to the spot, and picked up the largest pond pickerel I ever saw. When we had him in the boat the mystery was solved; the smaller of the fish had, in his eagerness for the swallow, jumped clear down the larger one's throat, and only the tail, to the extent of about an inch, showed. The large fish was completely rent asunder and killed by the catastrophe. Both together weighed 22 pounds."

Two telephone companies have been chartered in Paris by the government, and are now connecting their central offices with the residences and offices of the subscribers. The company using the Edison telephone charge six hundred francs a year. The Société Générale de Telephones uses the Gower telephone, and charges one thousand francs per year. The government reserves the privilege of buying out both companies.

ELECTRICAL RAILWAY.

The electric railway illustrated in the accompanying engravings, which we take from *La Nature*, was exhibited at the Berlin Exhibition of 1879. It presents a good example of the conversion of motive force into electricity and the conversion of the electric current back into motive force.

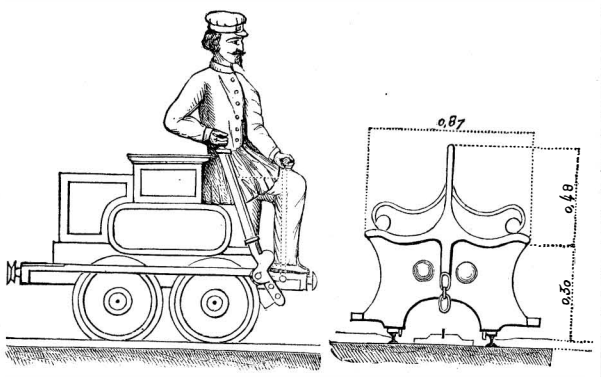

Fig. 1.—MOTOR. END OF CAR.

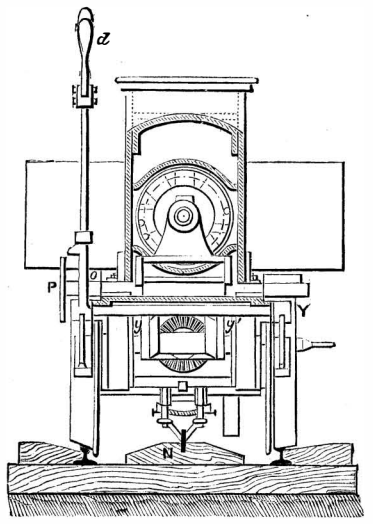

Fig. 2.—END VIEW OF MOTOR.

Two magnets or dynamo-electric machines, A and B, connected by metallic conductors, form a complete system for the transmission of power. If motion is imparted to the machine, A, an electric current will be produced which is converted into motive power by the machine, B. Of course the machine, B, delivers only a part of the power applied to the machine, A, and this amount of power transmitted varies with the nature of the machines, their speed, and the length of the conductors connecting them. Some machines are capable of delivering 60 per cent of the original power under favorable circumstances. A dynamo-electric machine operated by a steam engine, and connected by conductors with a second dynamo-electric machine mounted on a vehicle, the wheels of which are acted on by the second machine, constitutes an electric carriage or wagon. If the vehicle be placed upon rails, and the rails are used as conductors, the current being taken from an insulated rail by a metallic brush and returned to the electric generator by the ordinary uninsulated rails, we have an electric locomotive; connect a few cars with this locomotive and we have the electric railway as constructed by Dr. Werner Siemens, the well known German electrician, and exhibited at Berlin.

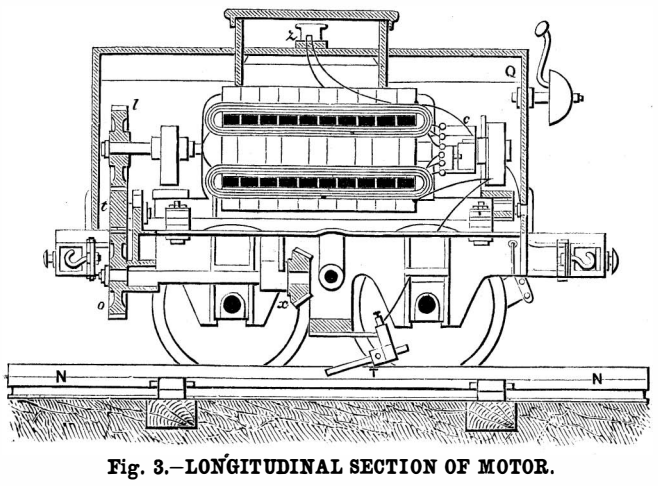

Fig. 3.—LONGITUDINAL SECTION OF MOTOR.

In the annexed cuts Fig. 1 represents a side view of the locomotive and a cross section of the cars, both drawn to a scale of $\frac{1}{10}$. Figs. 2 and 3 show detailed views of the locomotive on a scale of $\frac{1}{20}$. Fig. 4 shows the locomotive drawing three cars, each containing six passengers. The machines used are of the continuous current system of Siemens. The armature is rotated by means of the current received through the conductors from the stationary machine, and transmits its motion to the driving wheels through a number of gear wheels, *l*, *t*, *v*, *x*, *y*, which are necessary to reduce the speed.

The machine producing the current has one of its poles connected with the track rails, and the other pole is connected with the insulated central rail, N (Figs. 2 and 3), which is simply a conductor. A pair of brushes made of very fine copper wire, like the collectors of the Gramme machine, are kept in contact with the rail, N, completing the electrical communication between the rail and the machine. The current comes through the insulated rail, passes through the brushes, traverses the wires of the electric motor, and returns through the wheels and track rails.

The cars and the locomotive have an electrical connection through a copper wire. The sixteen wheels of the train form a perfect metallic communication between the locomotive and the rails for the return current.

The locomotive is started and stopped by a lever controlled by the driver sitting on the locomotive. The brake is operated in a similar way. The performance of the locomotive varies from 2 H. P. and a velocity of 6 feet per second, to 3½ H. P. and 12½ feet per second (7$\frac{9}{10}$ miles per hour), the train carrying eighteen passengers.

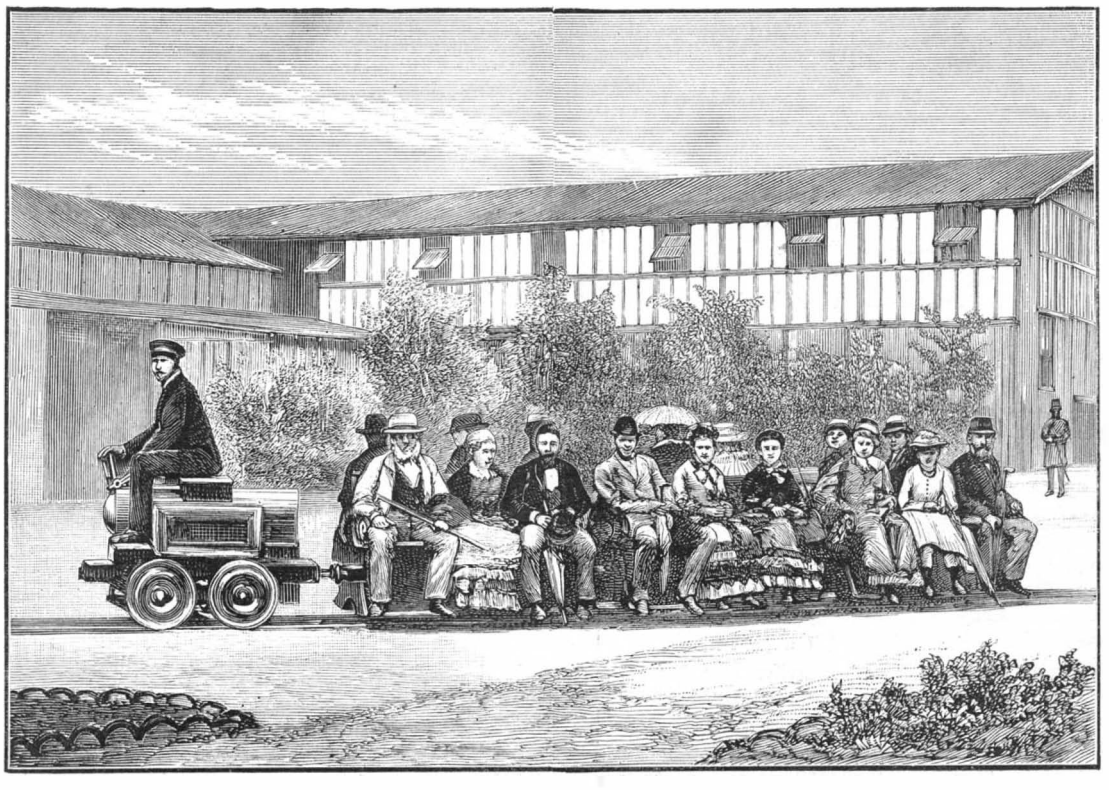

FIG. 4.—SIEMENS' ELECTRICAL RAILWAY.

MECHANICAL INVENTIONS.

Mr. Alfred H. Crockford, of Newark, N. J., has patented an improved brace for bits and drills of all kinds, whereby the bits and drills may be centered and firmly secured in the brace. The bits can also be readily applied to work in places or positions where the brace stock cannot have full swing.

An improved paper machine has been patented by Mr. William E. Phelps, of Lewisville, Pa. The object of this invention is to strengthen the paper by laying the fibers in all directions, instead of in the direction of the length of the paper only, as is now done.

Mr. Elijah Ware, of Omaha, Neb., has patented an improved spring power for watches and clocks. The object of this invention is to construct a spring power mechanical movement for use in watches and clocks, or for other purposes, where a small power is required, and to dispense with the train of gearing usually required. The inventor makes use of a spring attached to and coiled around a shaft that carries a loose and fast gear wheel, the spring being attached also to the loose gear, and the two wheels geared to a secondary shaft.

Mr. James A. Moore, of Kewanna, Ind., has invented a spring-propelled carriage, whose motive power is contained in a combination of coiled springs, levers, eccentrics, etc. These are so arranged upon a carriage as to be capable of exerting sufficient force after the springs are wound up to effect a long continued and economical propulsion of the carriage.

Improvements in pressing machines for printers, bookbinders, etc., have been patented by Mr. Joshua W. Jones, of Harrisburg, Pa. The object of this invention is to improve the construction of the machines for which letters patent Nos. 204,741 and 212,947 were granted to the same inventor June 11, 1878, and March 4, 1879, respectively, and which were illustrated in these columns some time since.

Mr. Ebenezer R. Gay, of Dubuque, Iowa, has patented a

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relishing or tenon finishing machine for use on rails for doors, blinds, panels, or other woodwork having rails with tenons and a groove or rabbet for panels. In such work, when the groove is not as wide as the tenon is thick, or does not have the same face as the tenon, a rib or projection is left, which has to be removed, and the improved machine is adapted for such operation.

In a movement for watches and clocks patented by Mr. Elijah Ware, of Omaha, Neb., the object is to dispense with the train of gearing generally employed in clocks and watches, and thereby simplify the construction and reduce friction. This movement cannot be clearly explained without engravings.

Mr. William Forshaw, of Chicago, Ill., has patented an improved platform for vehicles. The invention consists of a forked standard, whose lower end embraces the axle at its center, while its head supports the bolster plate; and secured between the forks of the standard and projecting laterally therefrom in both directions is a plate spring parallel with and above the axle, and connected at its ends with the axle by transverse elliptical springs that are secured to the axle near its shoulders; and it further consists of a device for supporting and a device for adjusting the elevation of the carriage pole.

A lawn-edge mower, patented by Mr. Timothy Hanley, of Boston Highlands, Mass., is an improvement on the lawn-edge mowers for which letters patent No. 220,829 were granted to the same inventor, October 21, 1879. With the improvements they may be used for mowing both high and low edges, as may be required.

An improved machine for making eyebolts has recently been patented by Messrs. Richard H. Briggs and James H. Dougherty, of Whistler, Ala. The object of this invention is to provide an improved machine that may be operated by hand or other power for the manufacture of eyebolts of any required dimensions.

Mr. Josephus T. Willis, of Mount Sterling, Ala., has patented a device for instantly detaching horses from vehicles. It consists of levers, sleeves, pivoted trace hooks, and a helical spring arranged upon a whiffletree and operated by pulling upon the governing strap.

George Wharton Simpson.

Mr. George Wharton Simpson, the proprietor and editor of the London *Photographic News*, died suddenly at his residence, Rose Lawn, Catford Bridge, Kent, on the 15th January last. His life, for many years past, had been devoted to the study of photography and its literature, and the history of the *Photographic News*, as that journal very justly observes, is practically that of the deceased gentleman.

Mr. Wharton Simpson was the author of many well known works connected with photography. The "Year Book of Photography" is probably the most important of all, of which an edition has annually appeared since 1859. "On the Production of Photographs in Pigments" is the title of a historical and practical treatise of carbon printing published in 1867, which is of value to this day; nor must we omit to mention an important contribution to the history of the photographic art published in the *British Quarterly Review*.

As a successful experimentalist, he has left his mark. He early predicted a great future for collodion, and worked for many years to improve this material as a vehicle for silver salts. About 1857 he undertook an exhaustive research upon collodions sensitized with bromine salts, and strongly advocated the use of these in conjunction with iron development, as against iodized collodion with pyrogallic development. In later years he brought forward the well known collodio-chloride process, or Simpsontype, as it has been called in America. The collodio-chloride process may be termed the most permanent silver printing process we have, since the collodion film permits of more thorough washing than the albumen film. Strange to say, although the Photographic Society awarded its silver medal to Mr. Simpson for the work, it was in Germany, France, and America where the process found most favor, and where collodio-chloride paper was generally manufactured

Finally, Mr. Simpson, we believe, enjoyed the reputation of being the only Englishman who has produced color by photographic printing. In experimenting with his collodio-chloride, he found one day that a portion of the material covered with ruby glass had become red under the action of the sun, the explanation, no doubt, being that the chloride in suspension had been changed by light to the violet sub-chloride, which had reproduced the tint of the glass above. The colors produced in photography by Niepce de St. Victor were secured, it is well known, by a similar use of what has been termed, for want of a better name, the violet sub-chloride of silver.

Mr. Wharton Simpson has served as vice-president of the Photographic Society, and of the South London Photographic Society since its commencement, and his ability, both in the world of literature and photography, placed him in a prominent public position for many years past.

Captain Minie.

The death is announced, at Paris, of Claude Etienne Minié, the inventor of many important improvements in fire-arms. Born in Paris about 1805, as soon as he was old enough M. Minié enlisted in the French army as a private, and served through several campaigns in Algeria. Promoted to a captaincy of chasseurs, he devoted himself to inventing improvements which would perfect the infantry service. Favored with the special protection of the Duke of Montpensier, he was able to secure the adoption of various improvements, which affected the shape and make of balls, cartridges, and gun barrels. He was decorated in 1849, and in 1852 made chief of a battalion of horse. M. Minié refused to go to Russia and apply his inventions there, although offered still further promotion. He was long in charge of the shooting gallery at the Normal School at Vincennes, and contributed largely to the perfection of portable arms. In 1858 he was invited by the Pasha of Egypt to go to Cairo and direct the manufacture of arms and a school of shooting there.

General Arthur J. Morin.

A Paris report of February 7 announces the death of Gen. Arthur Jules Morin. General Morin was born October 17, 1795, and entered the Foot Artillery of the French Army some time after attaining his majority. He became a General of Division in 1855, and was afterward made Director of the Conservatory of Arts and Trades. He was well known to the scientific world, having published many works connected with experimental mechanics, and aided largely in the advancement of that science in France. He was admitted to the Academy of Sciences in 1843, and in 1858 was made a grand officer in the Legion of Honor. General Morin was President of the Imperial Commission for the Exhibition of 1855, and in 1862 was made President of the Society of Civil Engineers of France.

Death from an Electric Shock.

An accident of an extraordinary nature occurred on Tuesday night, January 17, 1879, at the Holte Theater, Aston, a suburb of Birmingham. The stage is lighted by two electric lights, and when the candles are not burning, the connections used for the purpose of crossing the current are hung up over the orchestra. After the performance of the pantomine, Mr. Bruno, the euphonium player, was leaving with the other members of the band, when, presumably out of curiosity, he caught hold of the two brass connections referred to; the man in charge called out to him with the object of warning him of the danger he was incurring. The warning, however, came too late; Mr. Bruno received the full shock of the electric current, generated by a powerful battery which supplies the whole of the lamps in the building and grounds. It is said that the candles not being then burning Mr. Bruno was unable to disengage himself, and pulled the wire down. The shock rendered him insensible. A medical man was at once sent for, and restoratives were applied, but Mr. Bruno died in about forty minutes afterwards.—*The Electrician.*

MISCELLANEOUS INVENTIONS.

Mr. James Alfred Roberts, of Sydney, New South Wales, Australia, has invented an improvement in carriage lamps, which relates to the candle tubes of the lamps. The object of the invention is to facilitate the insertion of the candle into and its removal from the candle tube.

Mr. William H. Hawes, of New York city, has devised a pigeon trap, so constructed as to prevent the birds from remaining in the trap after the trap is sprung. The invention consists in combining a semi-cylindrical box, a middle pivoted cover, and a cord, arranged so that as the cover is tipped it will force the birds from the semi-cylindrical box.

Mr. John W. Smith, of Jersey City Heights, N. J., has patented a bunker for holding ice in markets, hotel provision rooms, vessels, and other places where a room is to be kept cool. It is so constructed as to effect a great saving of ice, while keeping the room cooler than the ordinary bunkers.

Mr. Francois Raymond, of Woodhaven, N. Y., has patented a new and improved folding bed, which is simple in construction, durable, and convenient.

Mr. Charles H. Cushing, of Tidioute, Pa., has invented an improved device for adjusting or locking and unlocking the plug of a stop cock. The plug may be firmly held in any desired position against any pressure of the liquid contained in the pipe to which the cock may be attached, and all wear on the plug or on its seat in the body may be compensated for by slightly turning down a nut.

Mr. Abram V. S. Hicks, of Rockville Center, N. Y., has patented an improved combined hammock and supporting frame. This invention is an improvement in the class of beds formed of a folding frame and a hammock attached thereto. It consists in the peculiar construction and arrangement of the parts of the frame.

An improved book holder, patented by Mr. John L. Highbarger, of Sharpsburg, Md., is designed for holding books open for convenience of reading. The device is applied to the upper end of a book cover; and it consists mainly of three parts—a bar or roller, two hooks or clasps, and two bent pivoted fingers. The hooks and fingers are attached to the ends of the bar or roller, and receive and tightly clamp the upper edges of the lids of the book, and are so attached to the bar that it is free to rotate. The pivoted fingers revolve with the roller, so that they may be turned into suitable position to enable them to hold the leaves of the book.

Mr. William Driscoll, of Brockville, Ontario, Canada, has patented a trap, which is an improvement upon the form of animal trap in which the weight of the animal is made to release a tilting platform and allow the animal to be precipitated into a tank of water, a barrel, or other receptacle placed beneath the trap. In this form of trap it has been a desideratum to secure a latch mechanism for locking the platform which is sufficiently sensitive to be tripped by small animals, like mice, as well as by rats or larger animals. This improvement aims at this result.

Mr. Henry L. Russell, of Bloomington, Ill., has invented an improved device for attachment to the leaders that conduct the rain water from the eavestroughs to the cisterns. It is so constructed as to adjust itself automatically to conduct the first water from the roof into the waste pipe and the succeeding water into the cistern, to prevent the coal dust and other dust that may settle upon the roof from being washed into the cistern.

Mr. Joseph W. Price, of Bryan, Ohio, has patented an improved bed bottom, which is so constructed that the cord or wire can be easily and conveniently tightened, and easily put in and taken out.

A bucket for taking bees from the hives to arrange the comb, for carrying them from one place to another, and for capturing bees in case of swarming on trees, has been patented by Gideon C. Finley and Sarah E. Finley, of Petersburg, Tenn. The invention consists in a bucket for transporting and capturing bees, having openings for the entrance and exit of the bees, an apron before the entrance slide, and openings for ventilation. The bucket is so arranged that it can be pulled to the top of a long pole if desired.

A carriage body, which is so formed that it may be extended to form a two-seated carriage, or contracted or folded to form a single-seated carriage, as may be required, has been patented by Mr. Horace C. Seely, of Philadelphia, Pa.

Messrs. Charles Holzner and Fred. Vohringer, of Louisville, Ky., have patented an improved coal hod. The invention relates to the manner of securing the base ring, bottom, helmet, and funnel or nose of a hod to the body thereof. This is done by crimping and wiring the parts together.

A simple, convenient, and inexpensive refrigerator crate for transporting butter, fruits, meats, game, etc., has been patented by Mr. George W. Freeman, of Amboy, Ill.

Mr. James M. Davis, of Knobel, Ark., has patented improvements in irons for connecting the traces with the hames, the object being to permit the pressure on the horse's shoulder to be shifted when necessary to avoid irritation, and also to lock the traces in the hooks attached to the hames.

Messrs. James Stroud and Oliver C. Titus, of New York city, have patented an improvement in wickets used on doors, especially in prisons or asylums, which have heretofore consisted simply of a barred opening. The object of this invention is to construct such wickets with doors or flaps, whereby they can be closed tightly and fit the wicket flaps in such a manner that they can be opened only from one side.

Mr. Ira D. Bush, of Detroit, Mich., has patented a door bolt, which is so arranged that it can operate like an ordinary door bolt, and will also hold the door when it is opened a distance equal to the length of the bolt.

A key-board attachment for musical instruments, patented by Mr. Christopher C. Reynolds, of Kelseyville, Cal., is to be used in connection with prepared music sheets to play the instrument by turning a crank, or by attachment to any suitable motor.

Mr. James M. Thayer, of Randolph, Mass., has patented a cheap, simple, convenient, and effective buckle for ties for bags. The invention consists of a rectangular frame of metal, perforated on one side for attachment to a strap, the frame having pivoted within it a tongue with a beveled serrated tip, and curved or rounded end bars for the strap to hold or engage against.

Messrs. Robinson Buckingham and Charles W. Poindexter, of Alto Pass, Ill., have patented an improved packer, designed to facilitate the pressing into boxes or packages of fruits and vegetables—as, for instance, peaches, early apples, pears, plums, or other fruit that will stand pressure when packed, or green peas, string beans, sweet and Irish potatoes, tomatoes, and other vegetables. The machine used for that purpose presses the fruit or vegetables by the lid into the box or package, and admits the convenient and quick nailing of the lid while being held on the box.

The First Stocking-Knitting Machine.

To the Editor of the Scientific American:

In an article in your paper (No. 9, vol. xlii.) it is stated that the first machine for knitting stockings by power was made by a man in Albany, N. Y., who, in 1831, succeeded in converting a common hand frame into one of that kind. This, if you will consult the records of the Patent Office, you will find to be a mistake, as a patent was granted to John Bazin, Jr., of Canton, Mass., dated October 28, 1814, for a machine for knitting by power. This was the first stocking machine ever made in this country, and was truly an original invention, the inventor not having seen any kind of machine for that purpose until long after he had completed his. One of these machines, which was in operation during the years 1815 and 1816, is still in existence, and, though somewhat damaged by want of proper care on the part of those who have had it in charge, could very easily be put in working order by a competent mechanic.

There were never more than four of these machines built, as some capitalists, who had bought the right to use them in a distant country, by trying to obtain control of the whole patent, not only lost all they had spent in the business, but succeeded in preventing the patentee from deriving any benefit from his invention.

J. A. B.

Canton, Mass., February 10, 1880.

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Business and Personal.

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The Edson Recording and Alarm Gauge, made and sold at 91 Liberty St., New York, causes a gong to ring in office and engine room when over-pressure occurs; and give written "charts" of all pressure carried, whether of air, steam, or water. Used in breweries, paper mills, hotels, city water works, charitable and educational institutions, and upon steamers, ferry boats, private yachts, and lighthouses. See card, with illustrations, in February number of Export Edition, under "Business Cards."

National Steel Tube Cleaner for cleaning boiler tubes. Adjustable, strong, durable. Chalmers-Spence Co., 40 John St., N. Y.

Wanted.—A good second-hand Pile Driving Engine. Address S. L. Wiley, Greenfield, Mass.

Wanted.—An Oil Mill of the most improved pattern, for the manufacture of cotton seed oil from the seed of the Sea Island cotton. State price and terms. Address Spirit of the Times, Jasper, Fla.

For Sale, in one lot, cheap, 200 "Mead" Sewing Machines, without stands. Apply P. O. Box 1595, Montreal, Canada.

For Sale.—The large factory building, at Marion Station, on the Pennsylvania Railroad, in Jersey City, formerly occupied by the United States Watch Co., together with the boilers, engine, shafting. The premises comprise three acres, inclosed by iron fence. Building 250 x 27, wing, 40 x 90. Apply to Jas. A. Alexander, No. 2 Cortlandt St., New York city.

A thoroughly practical mechanic desires to correspond with a firm in want of a draughtsman, who can design, construct, and execute. Has had many years' experience in improved steam power, millwork, and special tools. Address J. C. D., Box 773, New York.

Carre's French Cylindric Carbons for Electric Lights; assorted sizes; imported and for sale by C. Raoux, 246 Front St., New York city.

New Tubular Boiler, about five H. P., for sale cheap. Address W. N. W., Box 773, New York.

Scroll Saws; cheapest and best. D.S.Abbott,Olean,N.Y.

H. W. Johns' Asbestos Liquid Paints are strictly first-class pure linseed oil paints, and contain no water. They are the best and most economical paints in the world for structural purposes. H. W. Johns M'f'g Co., 87 Maiden Lane, sole manufacturers.

For Wood-Working Machinery, see illus. adv. p. 125.

Competent man wanted understanding wire rope conveyers for lumber, coal, etc. Address Rathbun & Co., Oswego, N. Y.

Steel Name Stamps, 15 cents per letter; steel figures, $1 per set. C. L. Anderson, Cleveland, Ohio.

For Mill Mach'y & Mill Furnishing, see illus. adv p.125.

Wanted.—A few sober, industrious Machinists and Moulders. Address H. B. Smith Machine Co., Smithville, Burl. Co., N. J.

New Inventions examined and tested. Designs and improvements. Reports for investors. Recipes and information on all industrial processes. Benjamin's Sci. Expert Office, 37 Park Row, New York.

Latest improved methods for working hard or soft metals, grinding long knives, tools, etc. Portable Chuck Jaws and Diamond Tools. Address American Twist Drill Co., Woonsocket, R. I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Chase's Pipe Cutting & Threading Machine. Send for circular. Chase Machine Co., 120 Front St., New York.

Sawyer's Own Book, Illustrated. Over 100 pages of valuable information. How to straighten saws, etc. Sent free by mail to any part of the world. Send your full address to Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 9 cents per pound. Fully warranted.

Ice Machines selected. Information on all kinds. Benjamin's Sci. Expert Office, 37 Park Row, New York.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

Special Tools for Railway Repair Shops. L. B. Flanders Machine Works, Philadelphia, Pa.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 126.

The "Fitchburg" Automatic Cut-off Horizontal Engines. The "Haskins" Engines and Boilers. Send for pamphlet. Fitchburg Steam Engine Co., Fitchb'g, Mass

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 62.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Blake's Belt Studs. The most durable fastening for rubber and leather belts. Greene, Tweed & Co., N. Y.

The Horton Lathe Chucks; prices reduced 25 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

$400 Vertical Engine, 30 H. P. See page 125.

Emery Wheels of all kinds, and Machines at reduced prices. Lehigh Valley Emery Wheel Co., Weissport, Pa.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 46.

Patent Steam Cranes. See illus. adv., page 125.

Nellis' Cast Tool Steel, Castings from which our specialty is Plow Shares. Also all kinds agricultural steels and ornamental fencings. Nellis, Shriver & Co., Pittsburg, Pa.

Best Turkey Emery in bbls., kegs, and cases. Special rates for large quantities. Greene, Tweed & Co., N. Y.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Circulars on application. Pittsburg Steel Casting Company, Pittsburg, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 125.

Deoxidized Bronze. Patent for machine and engine journals. Philadelphia Smelting Co., Phila., Pa.

Renshaw's Ratchet (short spindle) uses taper and square shank drills. Pratt & Whitney Co., Hartford, Ct

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

Catechism of the Locomotive, 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 126.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville N. J

The Twiss Automatic Cut-off; also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

J. F. Tallant, Engineer, Burlington, Iowa, makes a specialty of saving fuel and increasing power of defective boilers and engines.

Mica in sheet and scrap for sale in quantity to suit. Parties using Mica in any form please send for samples. Atlantis Land and Mining Co., Box 2762, Leadville, Col.

A No. 6 Root Blower, steel shafts of extra strength, and used less than four months, in good order. Charles L. Oudesluys & Son, 67 Exchange Place, Baltimore, Md.

Portable Forges, $12. Roberts, 107 Liberty St., N. Y.

For Sale.—Foundry and Machine Shop, third city in State; good business. Box 275, Winona, Minn.

Hydraulic Jacks and Presses. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Steam Engine for sale very low. See advertisement on another page.

A Rare Chance.—We have on hand a 40 H. P. Horizontal Oscillating Engine, built for special work, but never used. It is first-class in all respects; has patent guides to prevent wear; has balance wheel, but no pulley. Price $350. Heald, Sisco & Co., Baldwinsville, N. Y.

Campbell's Self-acting Window Shade Rollers are the best in the market. Models and terms to the trade. 85 Centre St., New York.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros. 531 Jefferson St., Philadelphia, Pa.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 110.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Eclipse Portable Engine. See illustrated adv., p. 94.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new 'Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 45.

NEW BOOKS AND PUBLICATIONS.

THE ALIENIST AND NEUROLOGIST. Quarterly, Vol. I. No. 1. Edited by C. H. Hughes, M.D. St. Louis: Ev. E. Carreras. Price $5 a year.

This journal of scientific, clinical, and forensic psychiatry and neurology, is intended especially to meet the wants of the general practitioner of medicine. Its fundamental idea is that these departments of medical practice are parts of the trunk rather than special branches of medicine; and it will be devoted to the promulgation, among general practitioners of medicine, of sound teaching respecting the nature and treatment of neuro-psychic and nervous diseases, the proper management and care of the insane, and kindred matters. The initial number shows a good list of contributions by capable writers.

VISITOR'S GUIDE TO THE SMITHSONIAN INSTITUTION AND NATIONAL MUSEUM, WASHINGTON, D. C. Edited by W. J. Rhees. Washington: Judd & Detweiler. Paper, pp. 96. Price 35 cents.

Contains an illustrated description of the present building, and a cut of the new building; also a descriptive guide to the cases and objects displayed in the several departments of the museum.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) H. D. P. writes: In No. 21 of SCIENTIFIC AMERICAN of 1879, you give receipt for making ink to be used with copying pad. In the receipt occurs the symbols (2R B to 3 B). Please explain their meaning in making the ink. I have asked a great many who should know, but they cannot tell me. A. The terms 2B, 3B, etc., are technical expressions descriptive of certain grades or degrees of color, as bluish blue, blue blue, blue, etc.

(2) H. J. D. asks: 1. Will brass make a durable cylinder for a small steam engine (bore 3 inches, stroke 4 inches)? A. Yes. 2. Will Babbitt metal do to pack the piston head, melt and run it in? A. It could be done, but would remain tight but a short time. Cast iron rings would be better. 3. What size should the induction ports be for cylinder 3 x 4 inches? A. 3/8 by 1 3/8 inches.

(3) E. N. J. writes: I am using stationary tubular boiler, 44 inches shell, 48 3-inch tubes, 12 feet long, fire passing underneath and returning through flues; have lined up fire box so that it is at least 4 inches narrower than the boiler. I claim that fire box ought to be at least 2 inches wider than the boiler to get the full benefit of our fuel, wood. Am I correct? If not, why? A. It is not necessary that the grate should be 4 inches wider than the diameter of the boiler, but the fire chamber above the grate should be at least 6 inches wider.

(4) G. H. S. asks if in the celebrated "Krupp one hundred ton steam hammer" the piston and hammer-head weigh together one hundred tons, and if so, is this the usual method of expressing the power of steam hammers. A. We suppose it to be the weight of the "tup," that is, hammer-head, piston, and rod, as the weight of steam hammers is generally spoken of in that way.

(5) C. L. H. asks. Can you give me any further instruction for making ink to use on the copying pad, in your SCIENTIFIC AMERICAN, No. 21? I have made some after that direction, as far as I understood it, and can get only about 10 fair copies; and by using ink furnished with other pads, can get 50 copies. Should be glad to receive any instructions you can give on the subject. A. You have probably used impure or improper aniline violet. Use pure 3 B methyl aniline violet.

(6) W. A. M. writes: I am desirous of building a steam yacht after the model of the one in SUPPLEMENT, No. 179, but propose to make it larger, 45 feet long by 10 feet beam. How many passengers will she carry, and what power engines will be needed? A. 18 to 22 passengers. 9 inch cylinder and 10 inch stroke.

(7) W. T. R. asks: 1. How can I prepare cyanide of silver for making a plating bath to use with a battery? A. Dissolve the silver in a small quantity of warm nitric acid. Evaporate nearly to dryness in a porcelain vessel, redissolve in pure water and add slowly solution (aqueous) of potassium until no further precipitate forms. Better decant the clear liquid, wash and dry the precipitated cyanide of silver. 2. Is chloride of gold used in its purity for a gilding solution? If not, please give directions for preparing it. A. No; use the cyanide of gold and potassium. 3. Will a gravity battery answer as well as a Smee for plating? I have been using it for plating some small articles, but have not had very good success. I prepared the solution by the battery process from silver coin. A. If properly managed, yes. 4. Is silver coin fit to prepare solution from or to use for anodes? A. Coin silver will not answer; it contains copper. 5. How much mercury does it take to operate a Sprengel air pump? A. From 20 to 50 lb. are commonly employed.

(8) W. S. B. asks: Is there any rule that will ascertain the pressure per square foot on a ship at different depths down its side? A. The pressure is 144 lb. per square foot for each 26 inches in depth, nearly. 2. Supposing a hollow tube could be plunged through the bottom of a ship, would the water rise and retain a position in the tube above the outside water level? A. No; it would rise to the height of the level of the water outside.

(9) J. K. writes: A states that the pressure of air necessary to keep the water from entering a diving bell is no greater at a depth of 500 feet than it is when the bell is only at a depth of 50 feet in the water. B states that on the contrary the greater the depth to which the bell is sunk in the water, the so much greater pressure of air is required to counterbalance the upward pressure of the water. Please state which is right, A or B. A. A is wrong. The pressure of air must be at least equal to the pressure due to the depth of water. B is right.

(10) W. E. K. asks how to take a large coal oil spot out of a carpet. A. Try benzole and woolen cloths.

(11) M. W. asks: 1. Is there any rotary engine equal in point of power to the best type of reciprocating engines? If so, who is the inventor and where is it manufactured? A. No. 2. Suppose a reciprocating engine turns 100 revolutions per minute, does it give any clearance? A. It must have some clearance to allow for the spring and play of the parts.

(12) H. D. writes: 1. I have an engraved copper plate which I wish to electroplate with steel. Can I do it, and how? A. Consult Gore's and Napier's Electro-metallurgies. 2. Can a Smee battery be used for the purpose? A. Yes.

(13) J. T. A. writes: There is a difference of opinion between a man and myself about a small steam boat as regards the government law. He says a small steam boat under five tons capacity has nothing to pay. I say they have to pay license and also inspection. A. You are right.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

M. F.—1. Mica schist with hornblende. 2. Syenite. 3 Zinc. 4. Red jasper. 5. Quartz, feldspar, and chalcopyrite. 6. Quartzose rock. 7. Sandstone. 8. Muscovite. 9. Sandstone. 10. Granite. 11. Quartz and trap. 12. Mica schist. 13. Limestone. 14. Chalcopyrite in talcose slate. 15. Gneiss and mica schist.

COMMUNICATIONS RECEIVED.

How to File the Champion Saw. By J. A. H.
On Limestone Built Cities. By J. S.
Five Sundays in February. By H. G. A.
On Inventors. By H. S. B.

[OFFICIAL.]

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FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 27, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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From January 23 to January 27, inclusive.

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Ice, manufacture of, A. J. Rossi, New York city.
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Propelling vehicles, C. L. French, Brooklyn, N. Y.
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Telephone signal apparatus, G. H. Bliss, Pittsfield, Mass.
Valve, slide, E. Robinson, Columbus, Ohio.

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THE SCIENTIFIC AMERICAN EXPORT EDITION FOR FEBRUARY, 1880, ILLUSTRATED WITH SEVENTY-NINE ENGRAVINGS.

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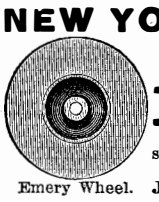

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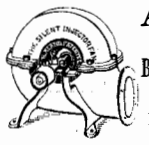

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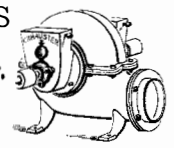

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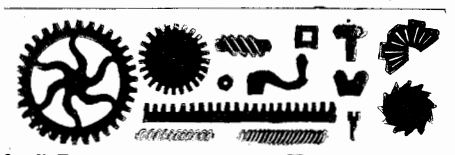

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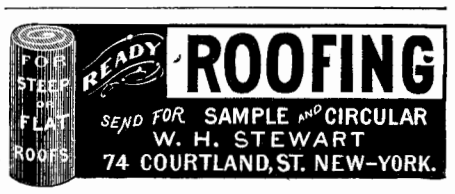

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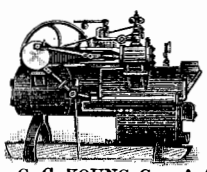

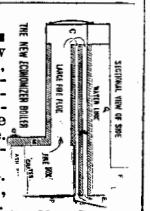

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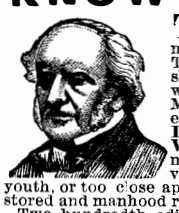

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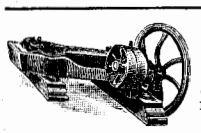

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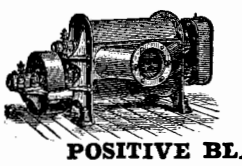

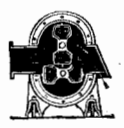

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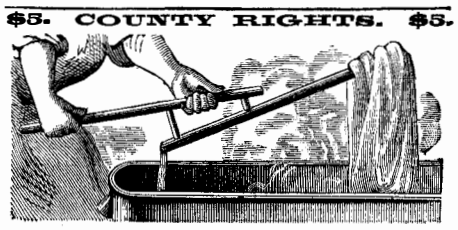

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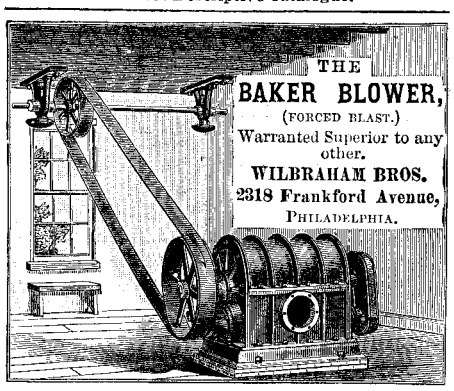

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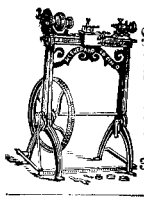

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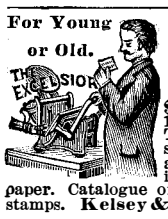

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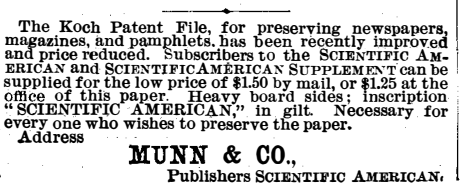

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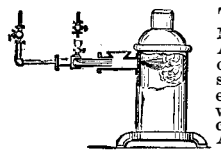

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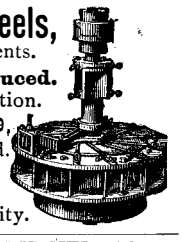

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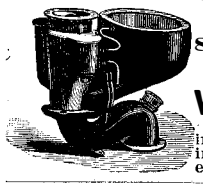

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